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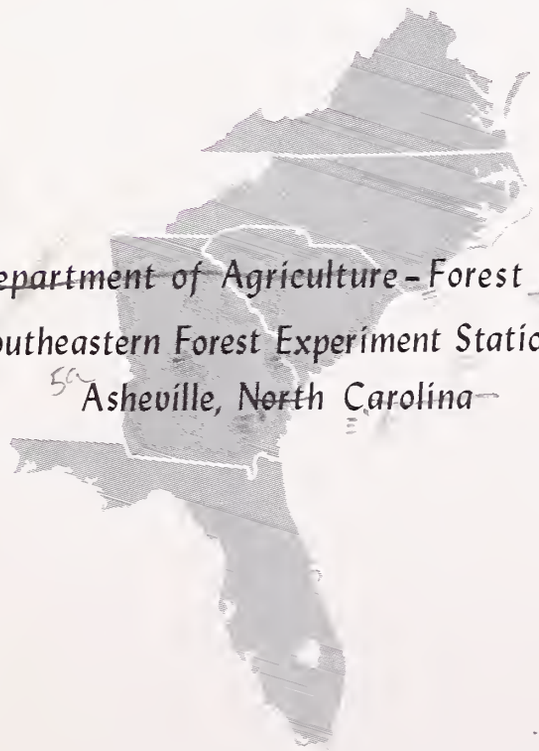
Wind Directions for Prescribed Burning in Southeastern United States

by

Daniel W. Krueger and Anthony M. Pachence



U.S. Department of Agriculture - Forest Service,
Southeastern Forest Experiment Station
Asheville, North Carolina

Wind Directions for Prescribed Burning in Southeastern United States

by

Daniel W. Krueger and Anthony M. Pachence 1/

INTRODUCTION

Prescribed burning is now being used for many purposes in the Southeast, such as fuel reduction, control of undesirable hardwoods, seedbed preparation, and disease control. Ideal weather for these burns varies with the purpose of the burn, the quantity and type of available fuel, and stand conditions. Practicing foresters differ in opinion as to the best weather for many of these purposes and conditions. In some years, the best burning conditions for a specific purpose may occur so infrequently that it may be necessary to burn during less favorable conditions. For example, the consensus in Florida, Georgia, and probably over much of the Southeast is that fuel reduction burning is best with "... a cold, steady wind from the North after a winter rain." 2/ 3/ 4/ 5/ In many places a "steady" north wind is rare.

Wind is recognized as the most important weather variable to be considered when using fire in the woods. It is generally agreed that burning cannot be safely undertaken unless the wind persists from about the same direction for the entire period of the burn. Any material change in wind direction is undesirable and a change of 90° or more could be disastrous.

1/ The senior author is Fire Weather Forecaster, U. S. Weather Bureau, assigned to the Southern Forest Fire Laboratory, Southeastern Forest Experiment Station, U. S. Forest Service. The junior author is Meteorological Technician, Southern Forest Fire Laboratory.

2/ Bickford, C. A., and Newcomb, L. S. Prescribed burning in the Florida flatwoods. U. S. Forest Serv. Fire Control Notes 8(1): 17-23. 1947.

3/ Hartman, A. A. Fire as a tool in southern pine. In Trees. U. S. Dept. Agr. Yearbook 1949: 517-527. 1949.

4/ Florida Board of Forestry. Controlled burning: using fire wisely. Fla. Forest Serv., 11 pp. 1956.

5/ Dyer, C. D., and Brightwell, C. N. Prescribed burning in slash and longleaf pine forests of Georgia. Ga. Agr. Col. Ext. Bul. 594, 15 pp. 1955.

OBJECTIVE

This study was made to find out which wind directions are most likely to persist 6 hours or longer when other weather conditions are forecast as suitable for burning and the frequency of these wind directions by month and location.

PROCEDURE

It was assumed that daytime burning should begin by late morning and the decision to burn (based on current and forecast weather) must be made by about 10 a. m. The 10 a. m. wind direction was, therefore, taken as the initial direction, and directions for the following 6 hours were compared with the 10 a. m. direction. For nighttime burning, 6 p. m. wind was used as the initial direction.

Hourly weather observations for the period 1950 through 1959 were used from the following U. S. Weather Bureau Stations: Macon and Savannah, Georgia; Jacksonville and Tallahassee, Florida; and Florence, South Carolina (daytime only). Daytime data only for the period 1948 through 1954 were used from the stations at Valdosta, Georgia, and Fort Myers, Florida. Locations of all stations are shown in figure 1.

Because burning cannot readily be done when the humidity is high, days when the average humidity for the 6-hour period (following 10 a. m. or 6 p. m.) was 70 percent or higher were not considered. Days with rain during the 6-hour period were also excluded. Strong winds increase the difficulty of controlling fires, so those days when the maximum wind during the 6-hour period was 20 knots or higher were also omitted. In burning practice, a forecast of adverse weather would have eliminated most of these cases.

For each station, month, and initial wind direction (to 16 compass points), the remaining data were divided into three classes. The boundaries of these classes are illustrated in figure 2. Class A represents cases where the wind varied less than 34° from the initial direction during the 6 hours following 10 a. m. (or 6 p. m.). Class B represents cases where the wind varied 34° or more but less than 79° from the initial direction, and Class C represents cases where the wind varied 79° or more from the initial direction. The average monthly frequency for each class was plotted in wind rose form (see Appendix). The best and poorest wind directions, from a wind persistency point of view, are shown in general terms in tables 1 and 2.

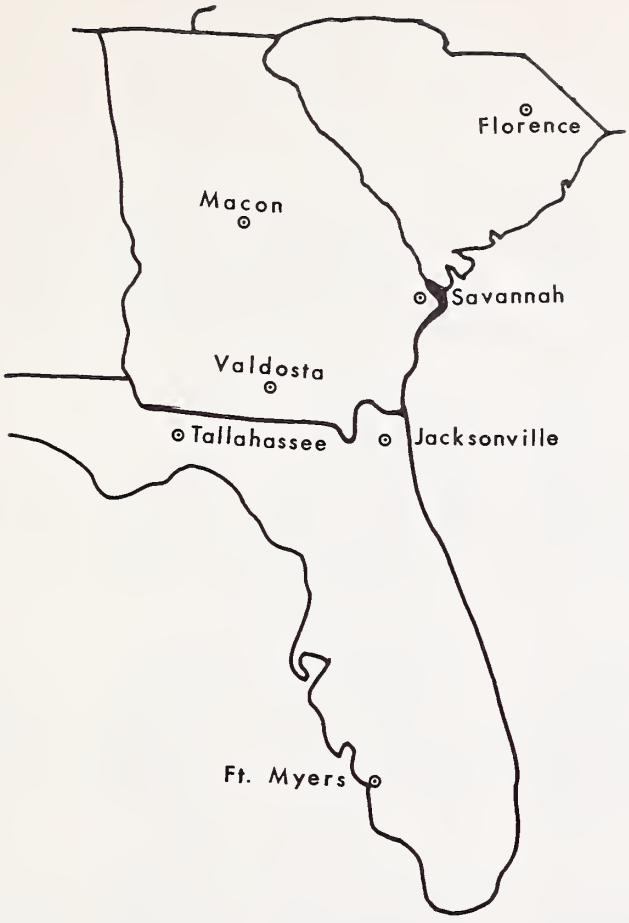


Figure 1. --Locations of stations used in this study.

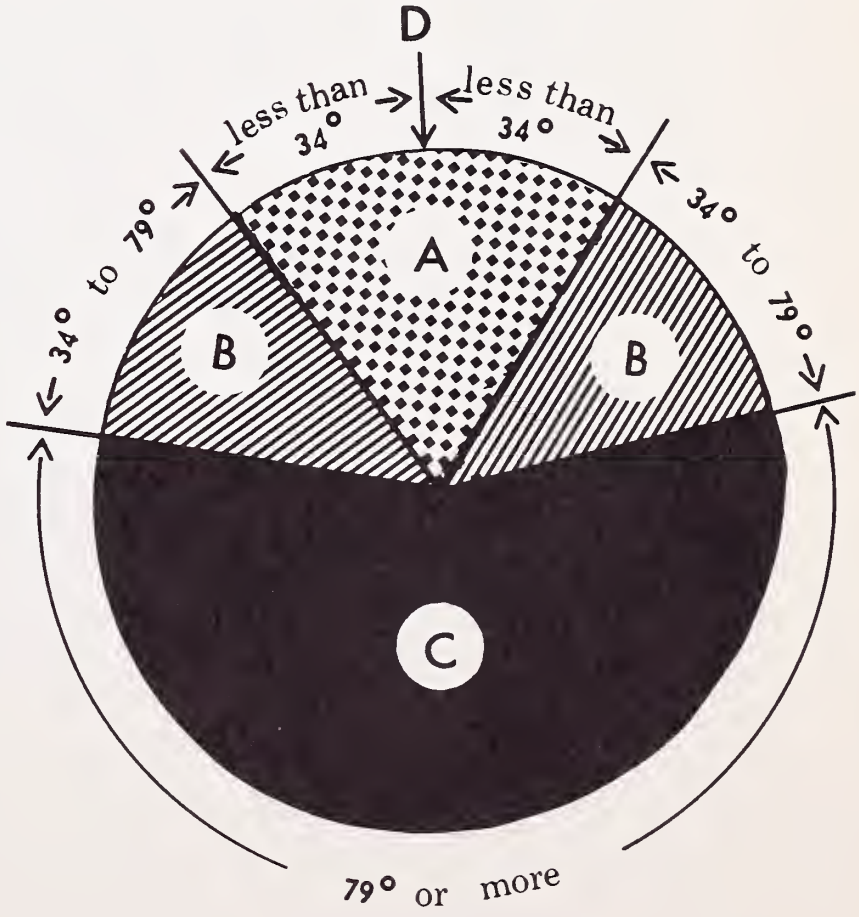


Figure 2. --Boundaries of the three classes in which data were divided. "A" wind persisted within 34° of initial direction "D," "B" wind varied 34° or more but less than 79°, and "C" wind varied 79° or more in the 6 hours following 10 a. m. or 6 p. m.

Table 1. --Best and poorest wind directions (from standpoint of wind persistency) for daytime prescribed burning by station and month, 1950 through 1959

Month	Type	Wind direction at observation stations						
		Florence, South Carolina	Macon, Georgia	Savannah, Georgia	Jacksonville, Florida	Valdosta, 1/ Georgia	Tallahassee, Florida	Ft. Myers, 1/ Florida
January	Best	SW'ly	Westerly	Westerly	Westerly	SW'ly	NW'ly	SE'ly 2/
	Poorest	SE'ly	Indeterminate	NE'ly	NE'ly	Easterly	Easterly	Indeterminate
February	Best	SW'ly	NW'ly	Westerly	Westerly	Westerly	Northerly	SE'ly 2/
	Poorest	NE'ly	Easterly	NE'ly	NE'ly	Easterly	Easterly	Easterly
March	Best	SW'ly	Westerly	Westerly	Westerly	SW'ly	NW'ly	SW'ly
	Poorest	Northerly	NE'ly	Northerly	Northerly	Easterly	Easterly	Easterly
April	Best	SW'ly	Westerly	Westerly	SE'ly	Westerly	NW'ly	SW'ly
	Poorest	Northerly	Easterly	SW'ly	Indeterminate	SE'ly	Easterly	Easterly
May	Best	SW'ly	Indeterminate	Westerly 2/	Easterly	SW'ly 2/	Southerly 2/	Westerly
	Poorest	Northerly	Indeterminate	SW'ly	SW'ly	Northerly	Easterly	Easterly
June	Best	SW'ly	Indeterminate	Westerly 2/	SE'ly 2/	Indeterminate	Indeterminate	Indeterminate
	Poorest	Northerly	Indeterminate	SW'ly	Westerly	NW'ly	Indeterminate	Indeterminate
July	Best	Southerly 2/	Indeterminate	Indeterminate	SE'ly	Indeterminate	Indeterminate	Indeterminate
	Poorest	Indeterminate	Indeterminate	SW'ly	SW'ly	Indeterminate	Indeterminate	SE'ly
August	Best	Indeterminate	Indeterminate	Easterly 2/	Easterly	Indeterminate	Indeterminate	SW'ly 2/
	Poorest	Indeterminate	Indeterminate	Westerly	Westerly	Indeterminate	Indeterminate	Easterly
September	Best	NE'ly	NE'ly 2/	NE'ly	Easterly	NE'ly	NE'ly 2/	Easterly 2/
	Poorest	SW'ly	Indeterminate	SW'ly	Westerly	Indeterminate	Indeterminate	Indeterminate
October	Best	NE'ly	NE'ly 2/	Easterly 2/	NE'ly	Easterly 2/	NE'ly	Easterly
	Poorest	NW'ly	Indeterminate	Northerly	NW'ly	Northerly	Indeterminate	Indeterminate
November	Best	SW'ly	NW'ly	Westerly	Westerly	Westerly	Northerly	Easterly 2/
	Poorest	NW'ly	Indeterminate	NE'ly	Northerly	NE'ly	Easterly	Indeterminate
December	Best	SW'ly	Westerly	Westerly	Westerly	NW'ly	Northerly	Easterly 2/
	Poorest	Indeterminate	Northerly	NE'ly	Northerly	Easterly	Easterly	Indeterminate

1/ Records for Valdosta, Georgia, and Fort Myers, Florida, cover period 1948 through 1954 only.
2/ Best direction, but still rather poor.

Table 2. --Best and poorest wind directions (from point of wind persistency) for nighttime prescribed burning by station and month, 1950 through 1959

Month	Type	Wind direction at observation stations			
		Macon, Georgia	Savannah, Georgia	Jacksonville, Florida	Tallahassee, Florida
January	Best	NW'ly	Westerly	Westerly	NW'ly
	Poorest	Southerly	Indeterminate	Indeterminate	Indeterminate
February	Best	Westerly	Westerly	Westerly	NW'ly
	Poorest	Indeterminate	Indeterminate	Indeterminate	Indeterminate
March	Best	NW'ly	Westerly	Westerly	NW'ly 1/
	Poorest	Indeterminate	Indeterminate	Easterly	Indeterminate
April	Best	NW'ly	Westerly	Westerly	NW'ly 1/
	Poorest	Indeterminate	Indeterminate	Easterly	Indeterminate
May	Best	NW'ly 1/	Indeterminate	SW'ly 1/	Indeterminate
	Poorest	Indeterminate	Westerly	SE'ly	Southerly
June	Best	Indeterminate	Indeterminate	Indeterminate	Indeterminate
	Poorest	Indeterminate	Indeterminate	SE'ly	Indeterminate
July	Best	Indeterminate	Indeterminate	Indeterminate	Indeterminate
	Poorest	Indeterminate	Indeterminate	SE'ly	Indeterminate
August	Best	Westerly 1/	Indeterminate	Indeterminate	Indeterminate
	Poorest	Indeterminate	Indeterminate	Indeterminate	Northerly
September	Best	NE'ly	NE'ly 1/	Indeterminate	NE'ly 1/
	Poorest	Indeterminate	Indeterminate	Indeterminate	Indeterminate
October	Best	NW'ly	NE'ly	Westerly	NE'ly
	Poorest	Easterly	Indeterminate	Indeterminate	Indeterminate
November	Best	Westerly	Westerly	Westerly	NW'ly
	Poorest	Indeterminate	Indeterminate	Indeterminate	Indeterminate
December	Best	Westerly	Westerly	Westerly	NW'ly
	Poorest	Indeterminate	Indeterminate	Indeterminate	Indeterminate

1/ Best direction, but still rather poor.

DISCUSSION OF RESULTS

For the coastal plain of Georgia, South Carolina, and northern Florida, a few general conclusions can be drawn:

1. During the winter burning season (December, January, February, and March), winds with a westerly component are more persistent than those with an easterly component.

2. In early autumn (September and October), northeasterly winds are most persistent, while November is a transitional month between the early autumn and winter regimes.

3. The other months are much less consistent, and in many areas favorable winds are so rare that burning may be impractical in the warmer months.

4. The more persistent nighttime wind directions are about the same as those in the daytime. Higher nighttime humidities, however, exclude many of the nights from consideration.

Data from more stations in south and central Florida are needed to determine if the Fort Myers results are applicable over any extended area.

For planning burns, the wind roses in the Appendix provide much more detailed information than tables 1 and 2, and the most persistent wind direction (dotted area persisted within 34° and hatched area varied between 34° and 79°) can be determined from them (fig. 3). If this direction also indicates a low number of days when the wind varied 79° or more (solid area), it is probably the safest one for burning. Before burning, however, check the latest fire weather forecast.

In some cases several directions are almost equally good. Landowners with large acreages to burn may want to plow lines in different directions on the various tracts to take advantage of each of these persisting winds.

Local terrain affects wind direction. It would probably be useful for landowners to record for some time the wind direction in the area they plan to burn and then compare these directions with those reported by the nearest U. S. Weather Bureau Office used in this study. If consistent differences are noted, it may be possible to adapt the data in the Appendix to reflect these differences. In hilly terrain and in coastal areas influenced by land and sea breezes, these differences are especially important.

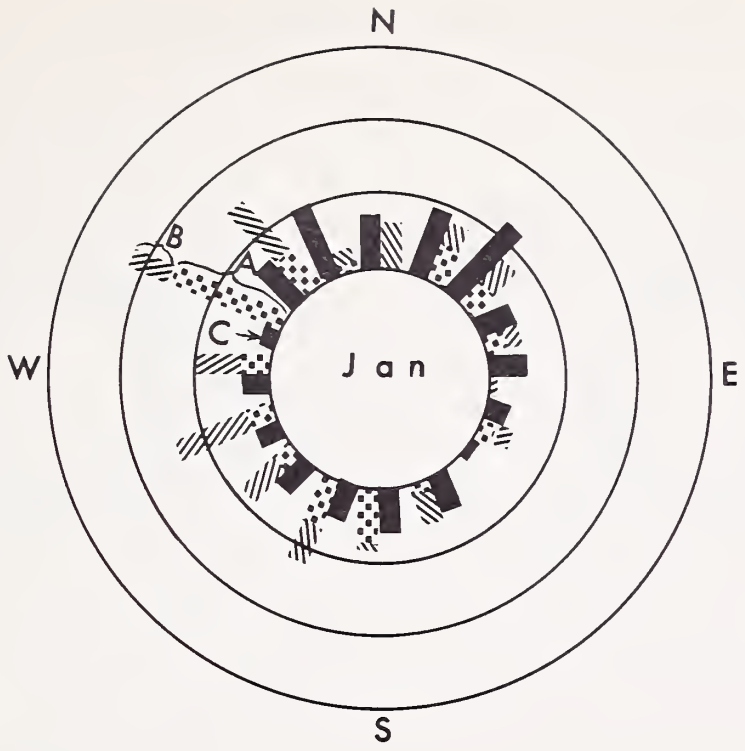


Figure 3.--Example of windrose reproduced from Appendix (Jacksonville, Florida, daytime, January).

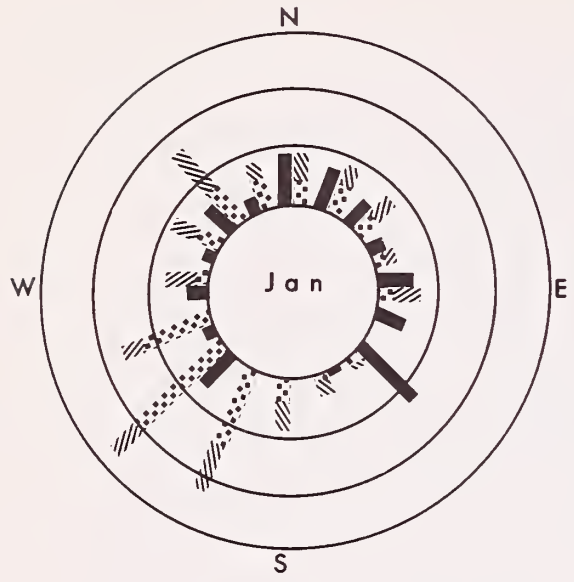
Appendix

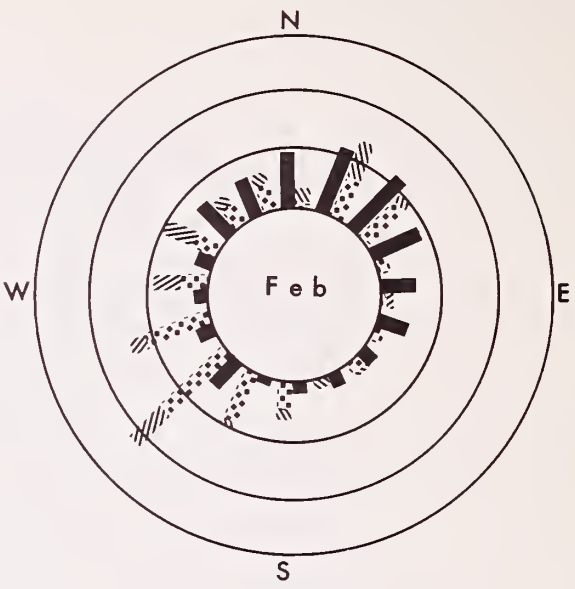
Wind roses for each month and station show the average number of days (distances between concentric circles represent one day) that the 10 a.m. wind (6 p.m. for nighttime data) persisted within 34° (dotted area), varied between 34° and 79° (hatched area), varied 79° or more (solid area) during the 6 hours after 10 a.m. (or 6 p.m.)

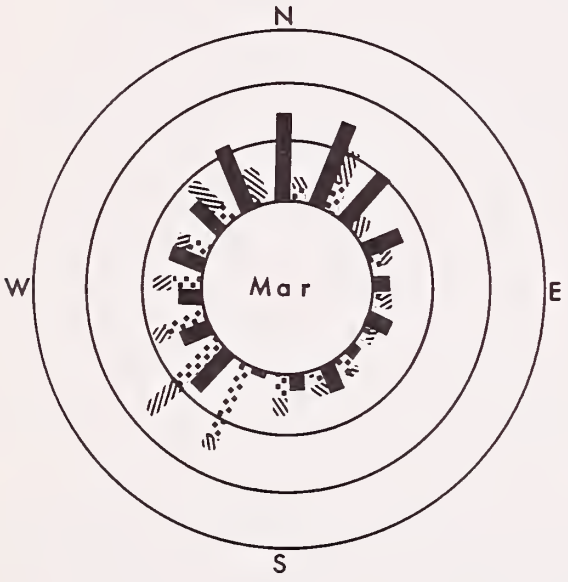
For example, the Jacksonville, Florida, (daytime) wind rose for January (fig. 3) indicates that a wind from the west-northwest is most persistent. An average of 1.6 days (A) had a west-northwest wind at 10 a.m. which persisted within 34° for 6 hours or longer. On an average of 0.6 day (B) the 10 a.m. wind from that direction varied between 34° and 79°, whereas an average of only 0.2 day (C) had 10 a.m. west-northwest winds that varied 79° or more. In general, all of the 10 a.m. directions from south-southeast clockwise through northwest persisted within 79° more frequently than they varied 79° or more.

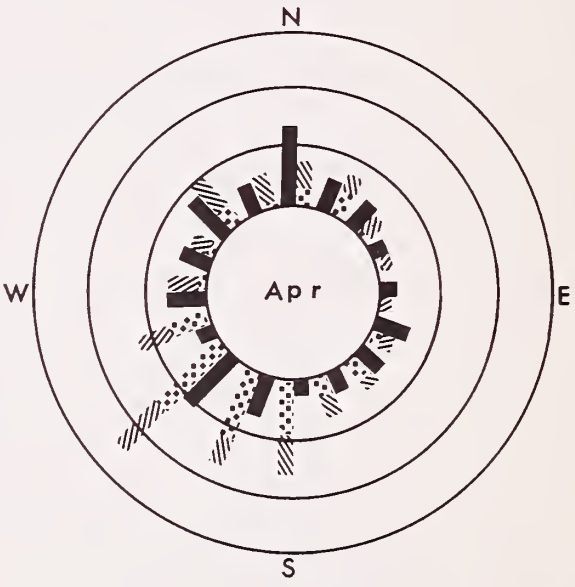
Wind rose data are for the 10-year period, 1950 through 1959, except data from Valdosta, Georgia, and Fort Myers, Florida, that are for a 7-year period, 1948 through 1954.

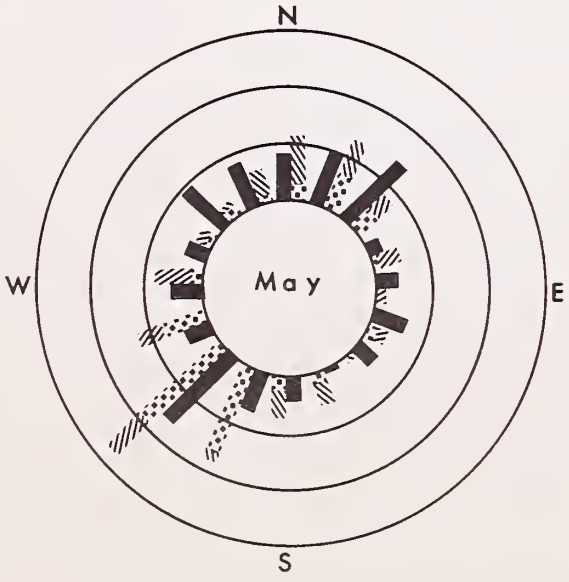
FLORENCE, SOUTH CAROLINA (daytime)

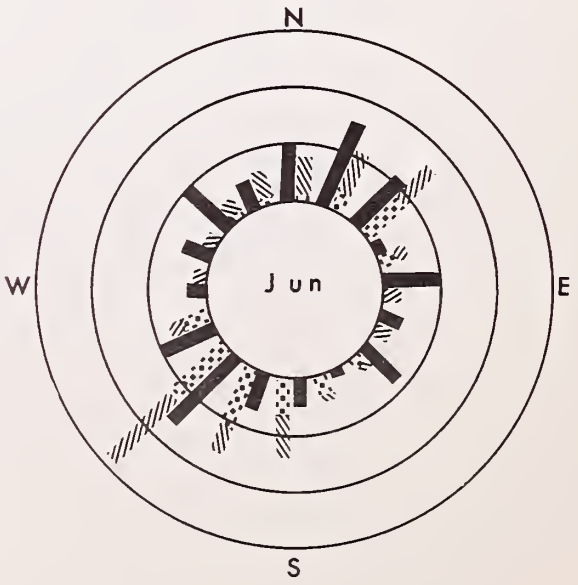




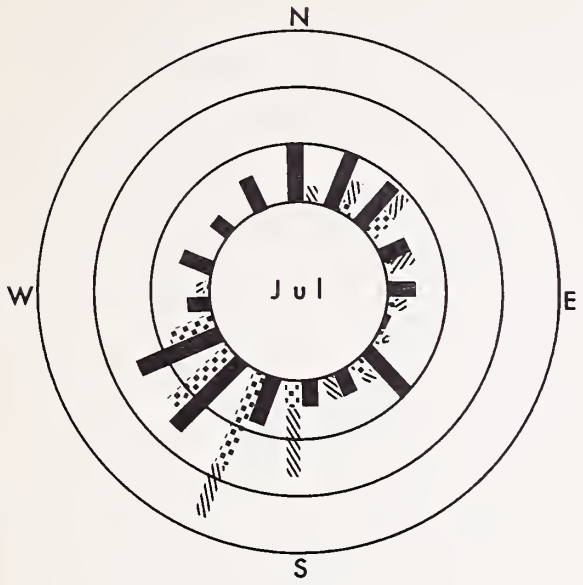


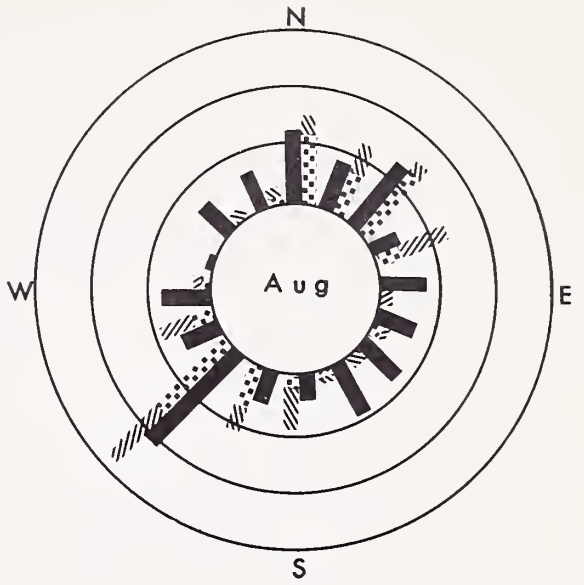


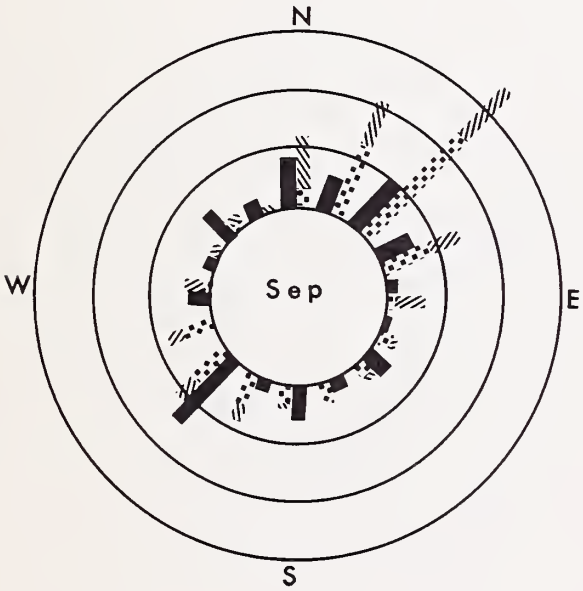


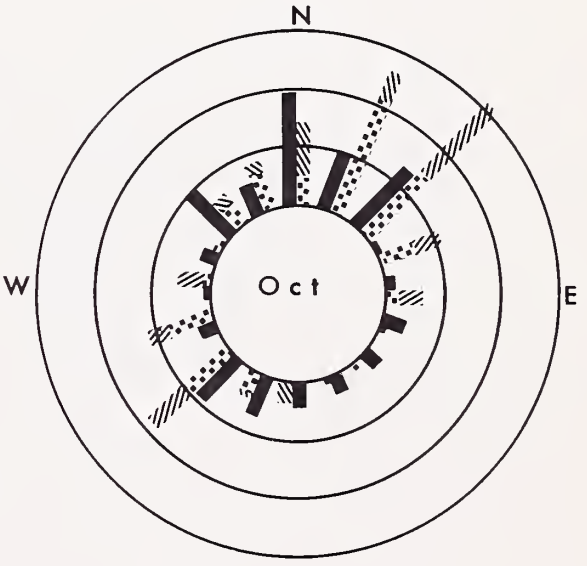


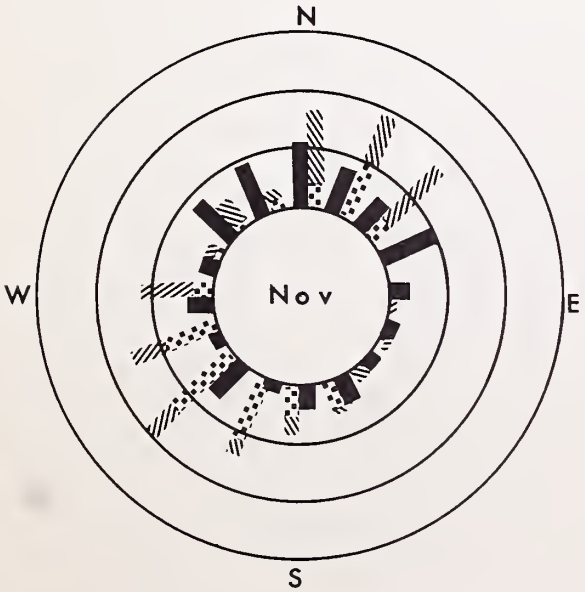
FLORENCE, SOUTH CAROLINA (daytime)

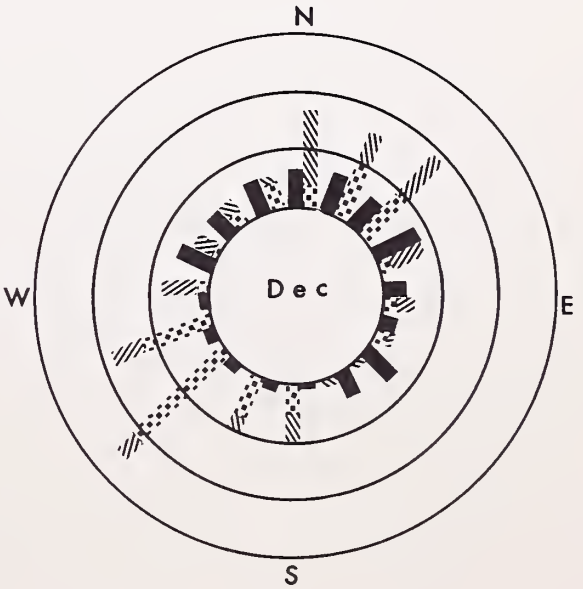












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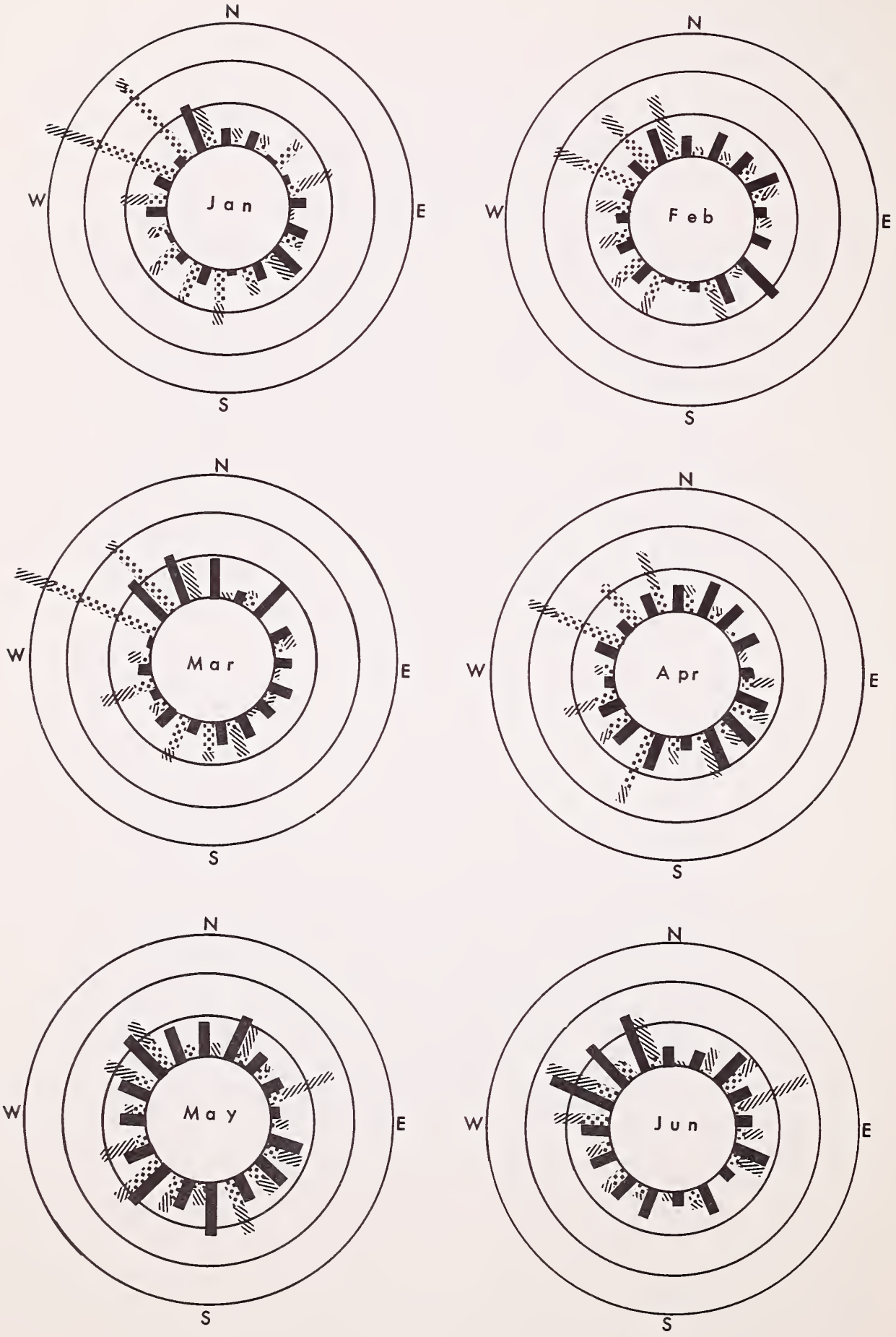

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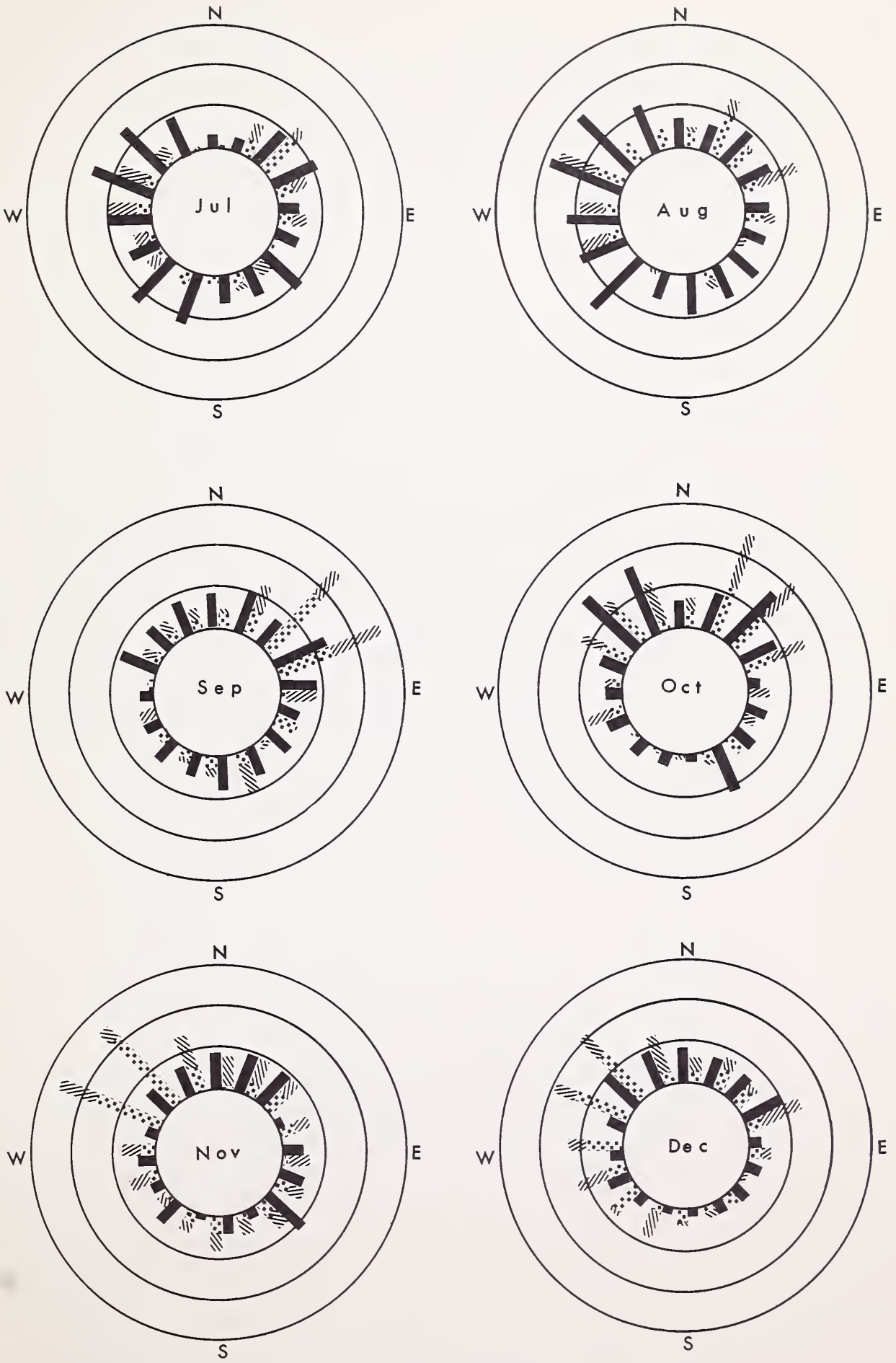

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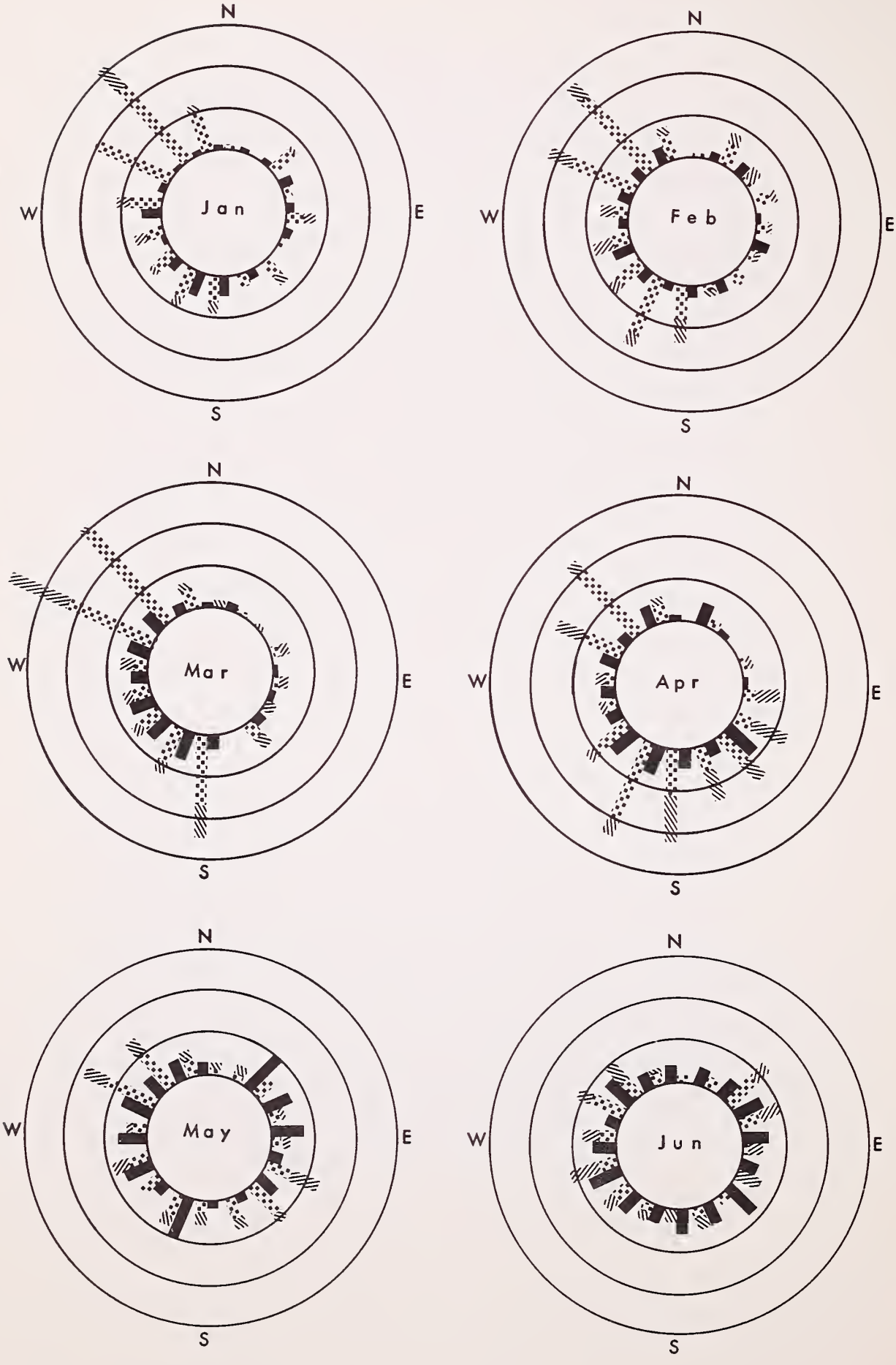

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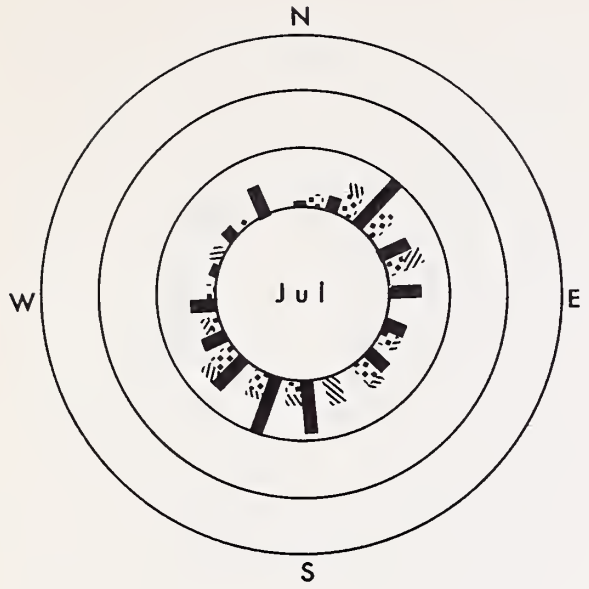
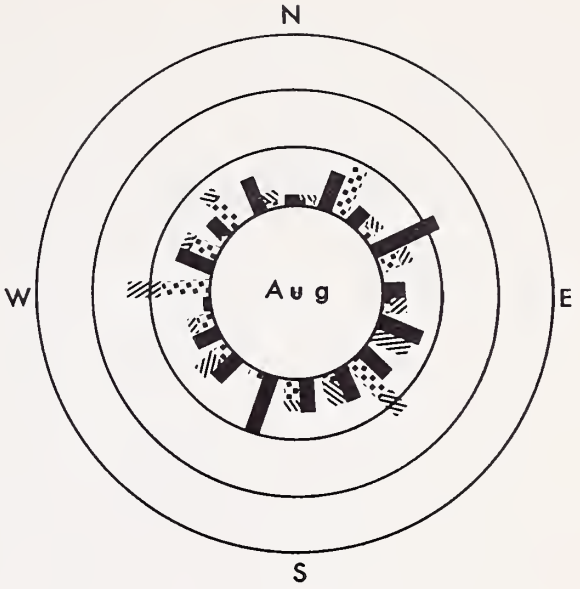
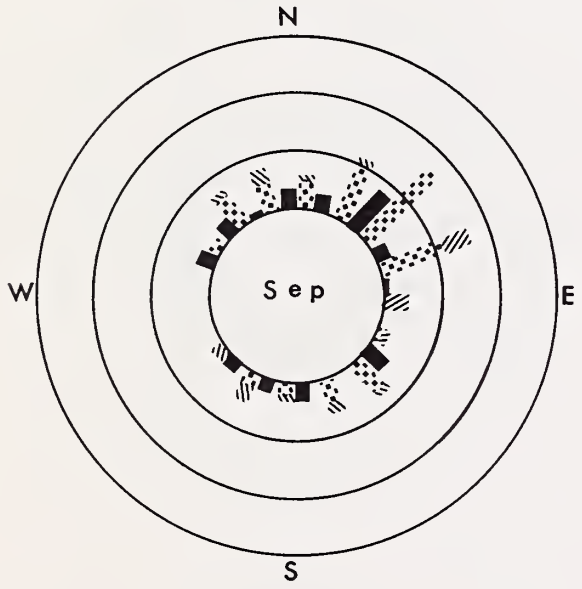
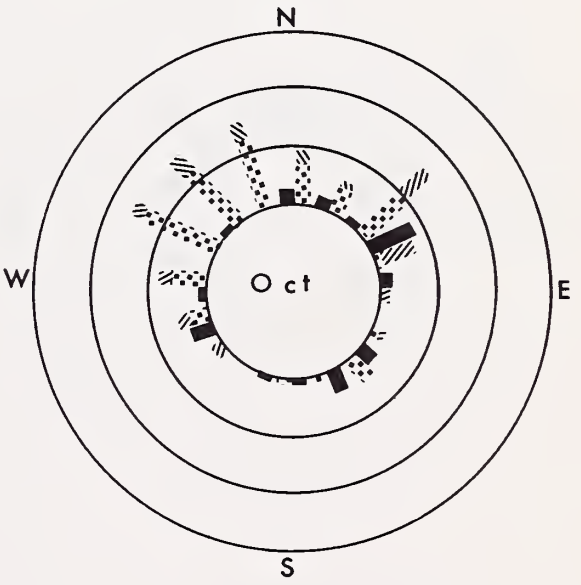
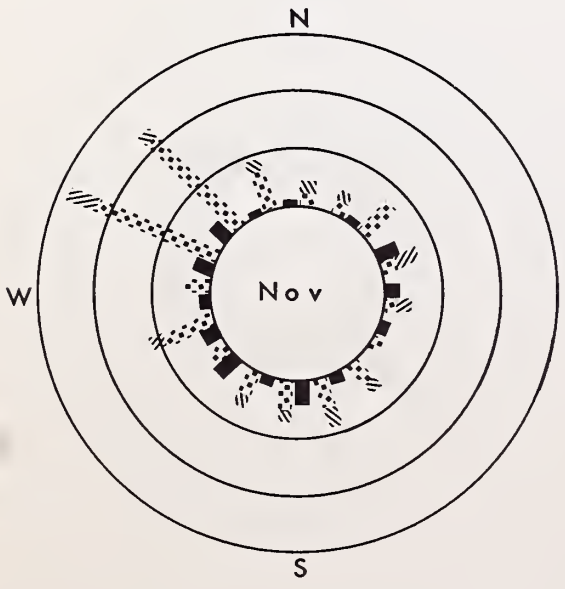
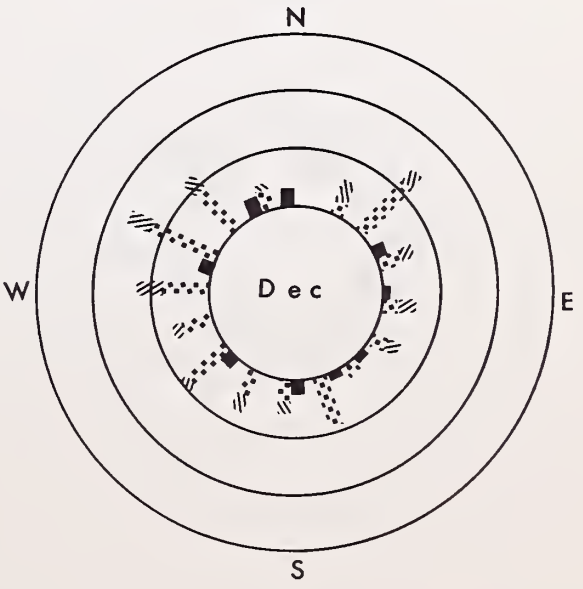




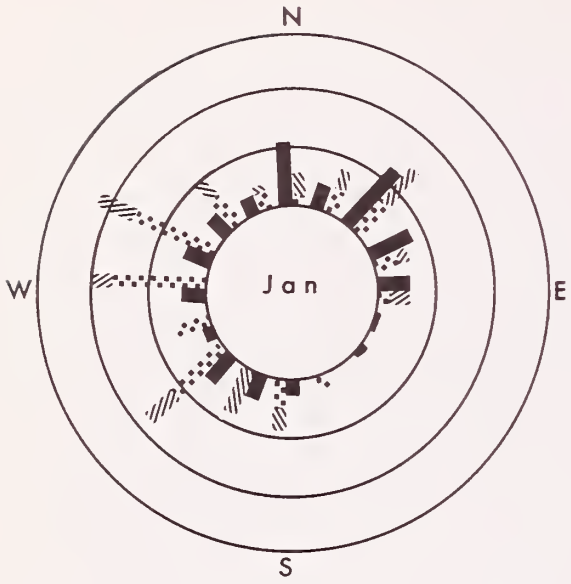


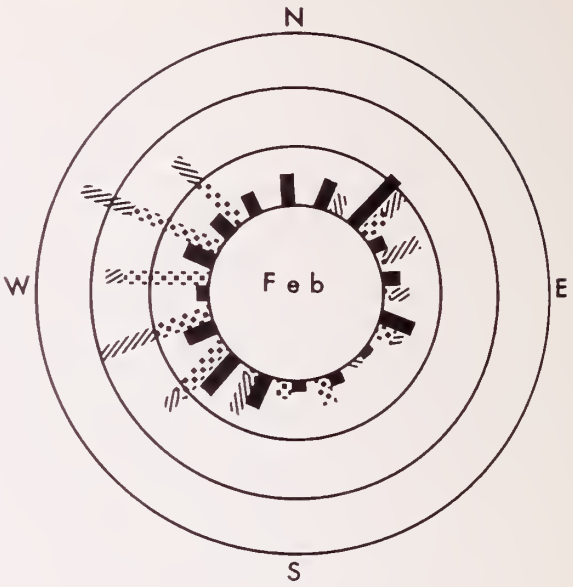


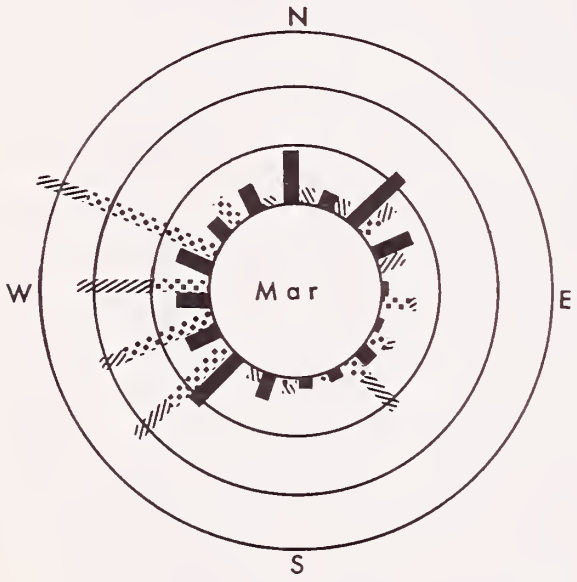


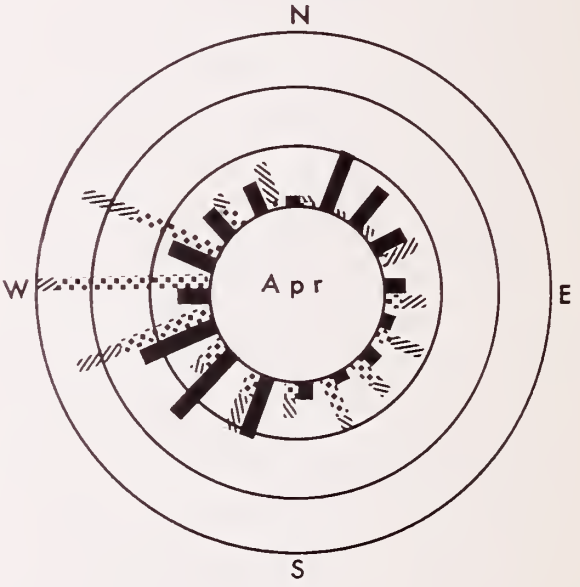


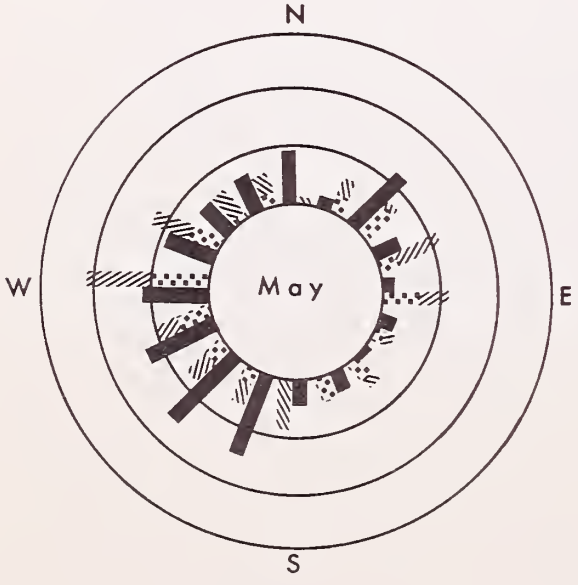
SAVANNAH, GEORGIA (daytime)

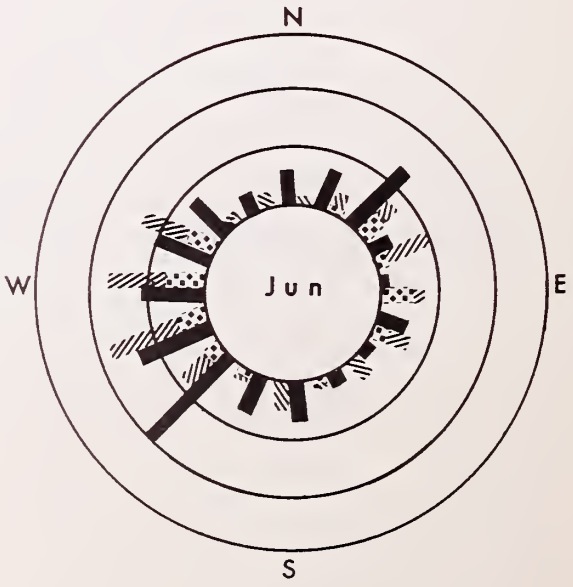




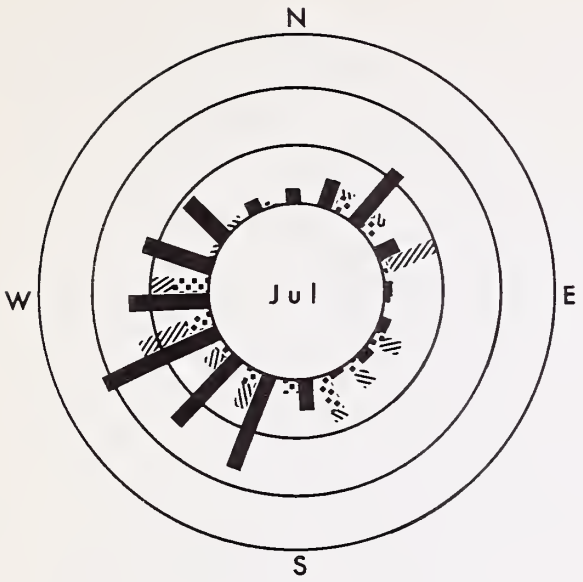


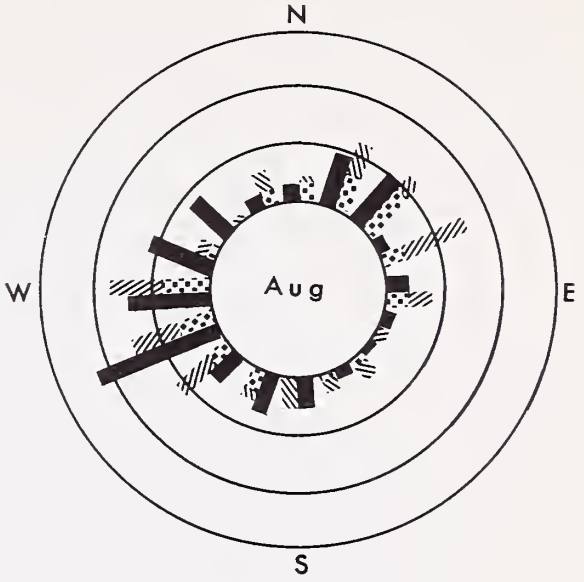


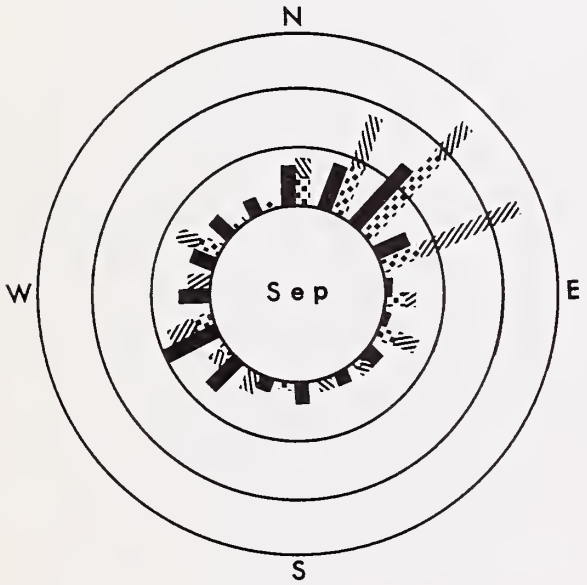


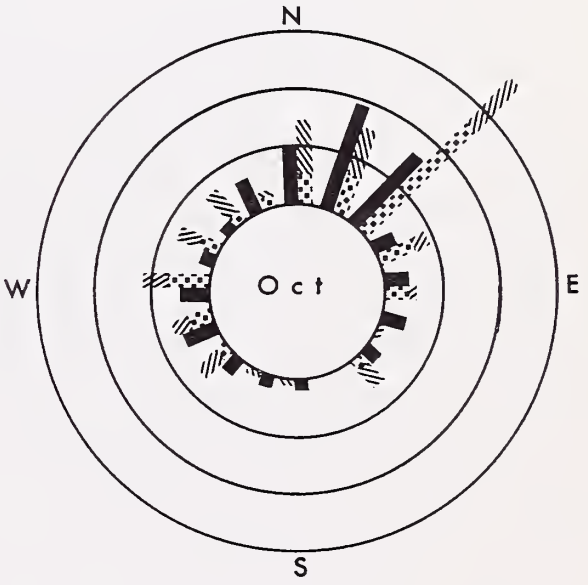


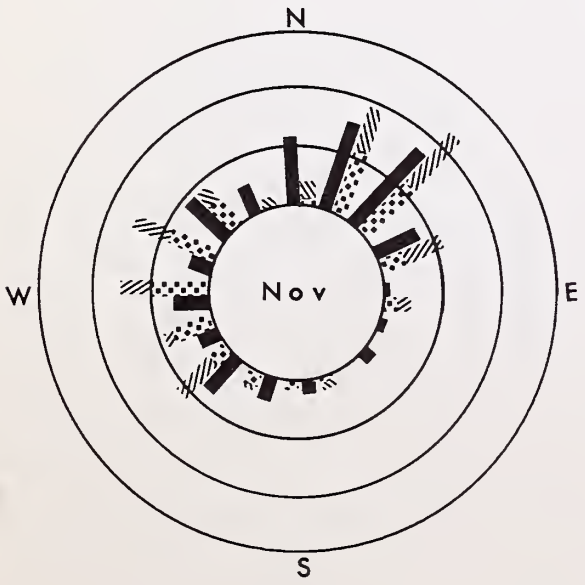
SAVANNAH, GEORGIA (daytime)

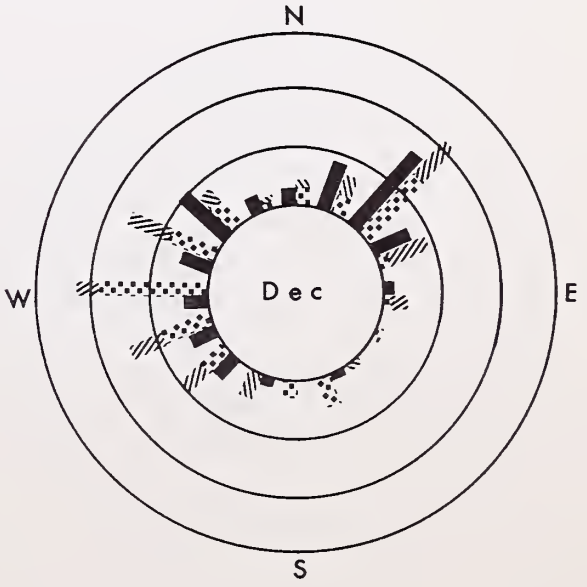




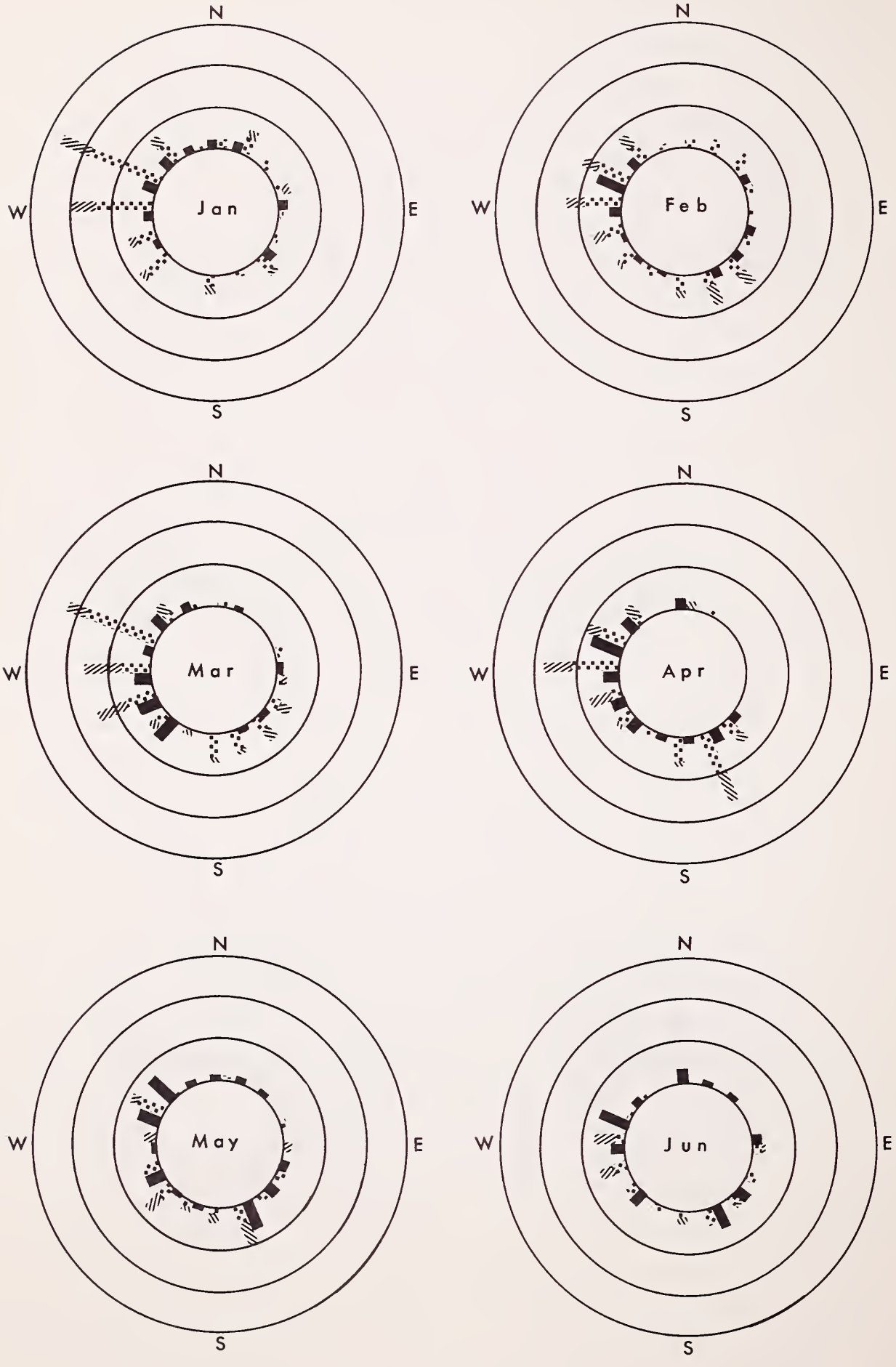




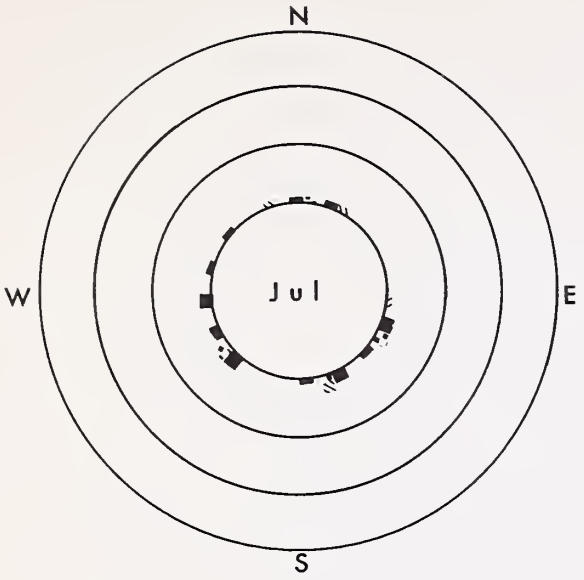


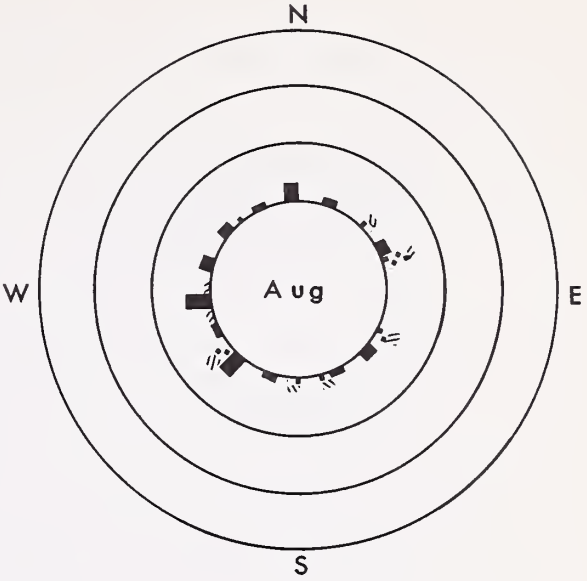


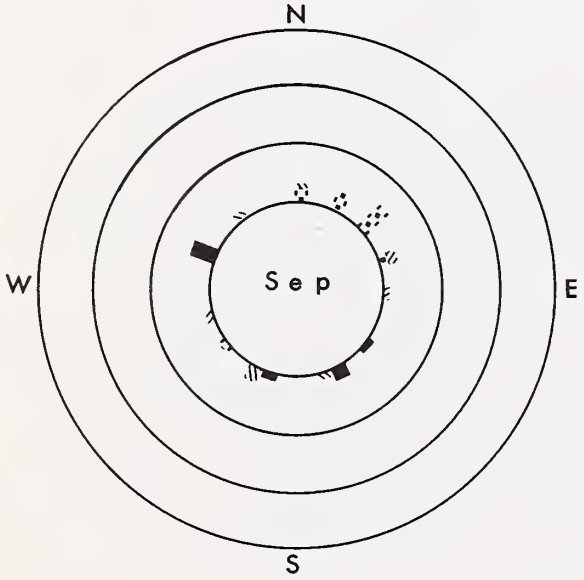
SAVANNAH, GEORGIA (nighttime)

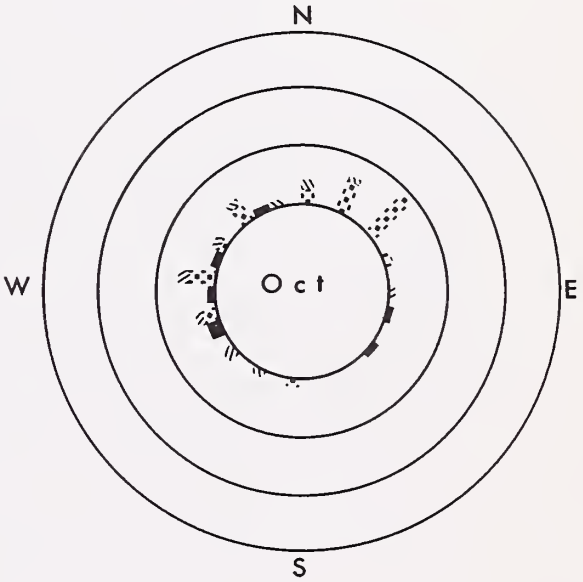


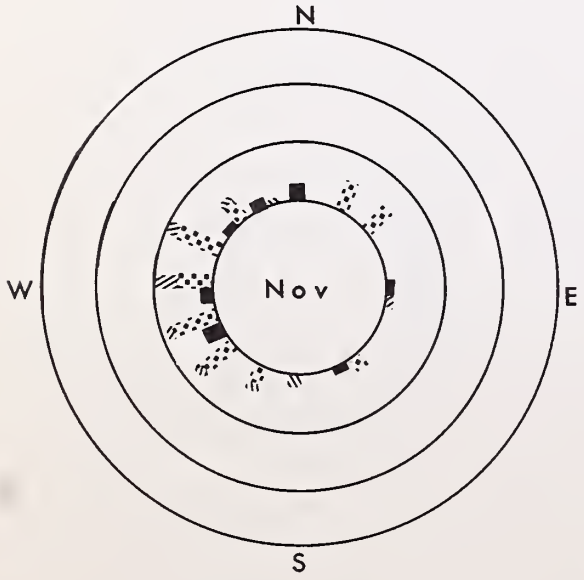
SAVANNAH, GEORGIA (nighttime)

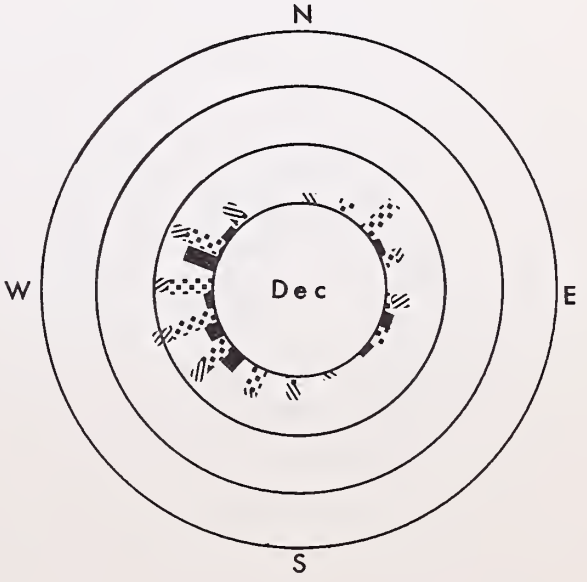




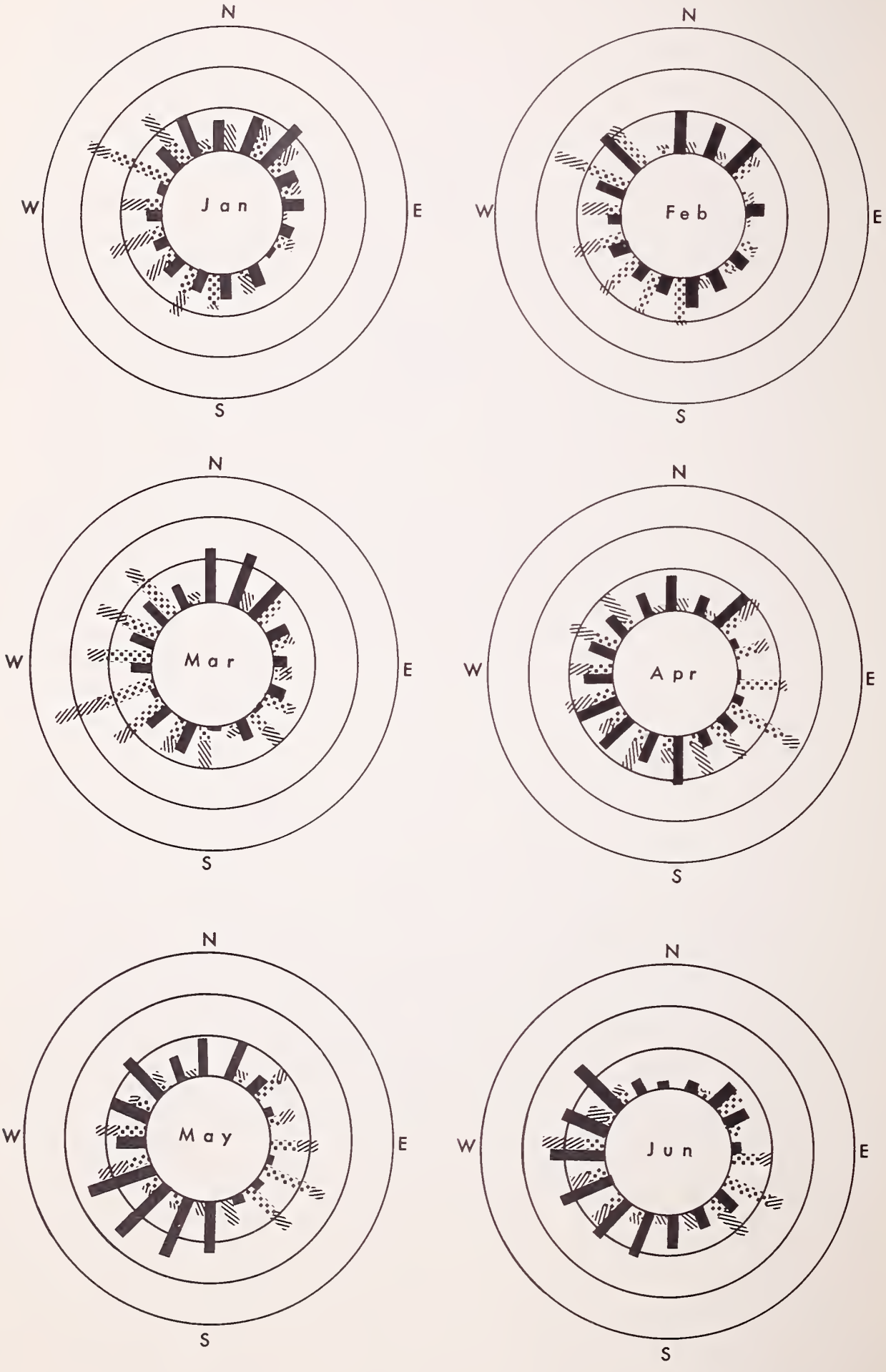


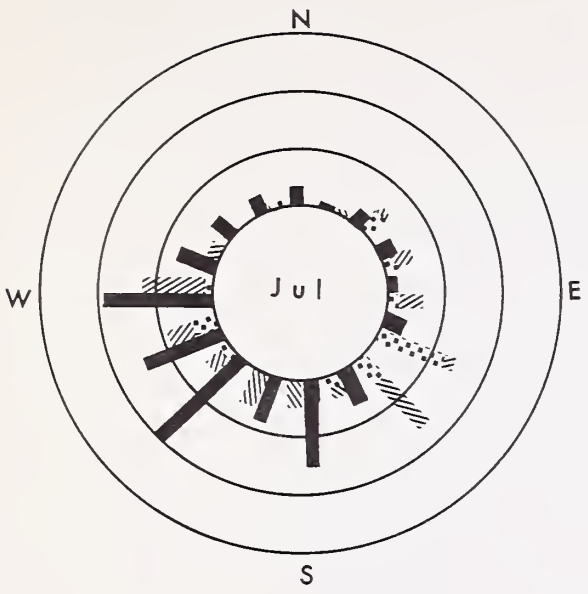






JACKSONVILLE, FLORIDA (daytime)

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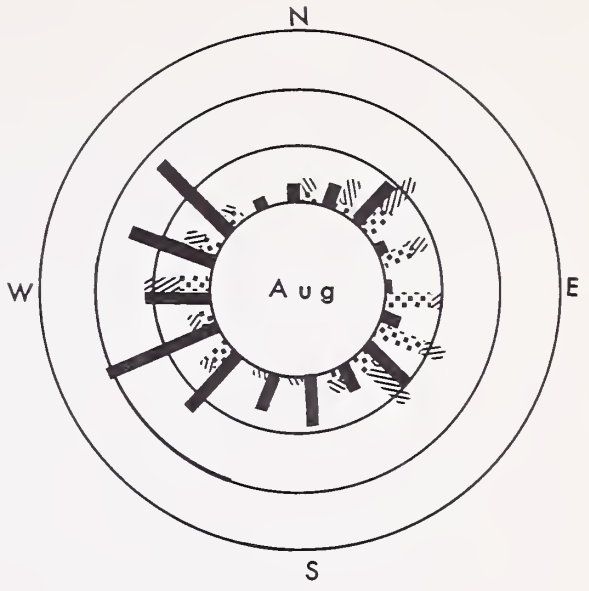
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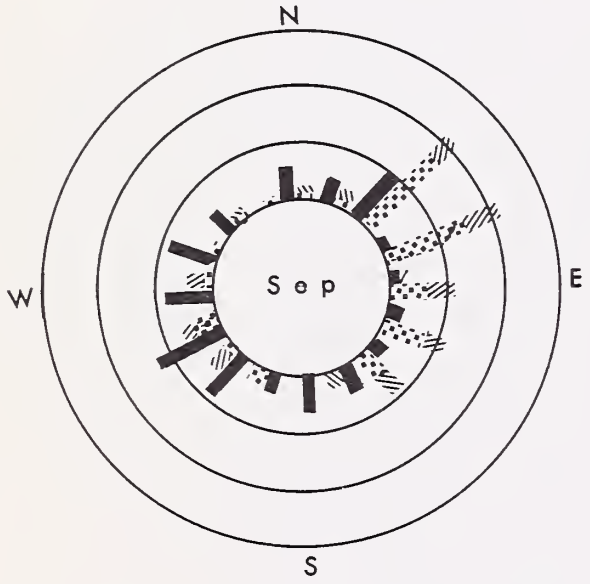
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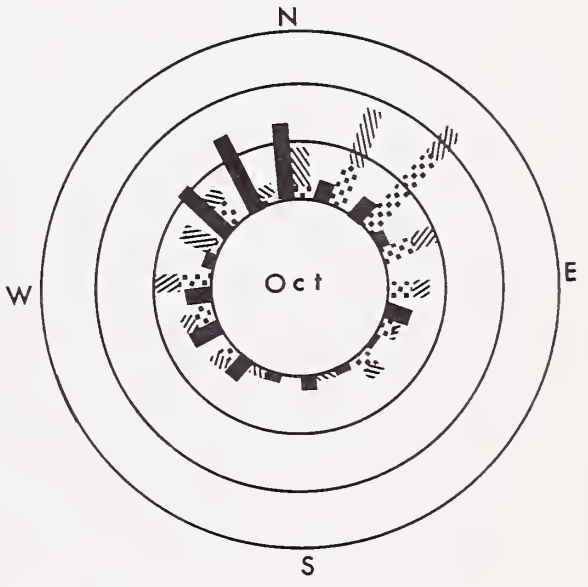
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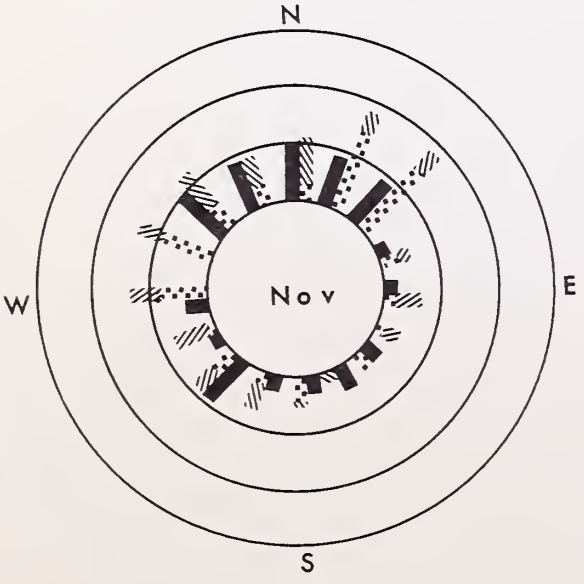
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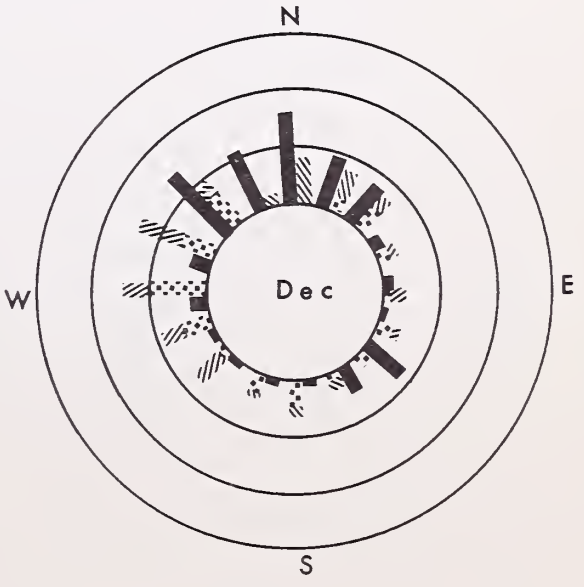
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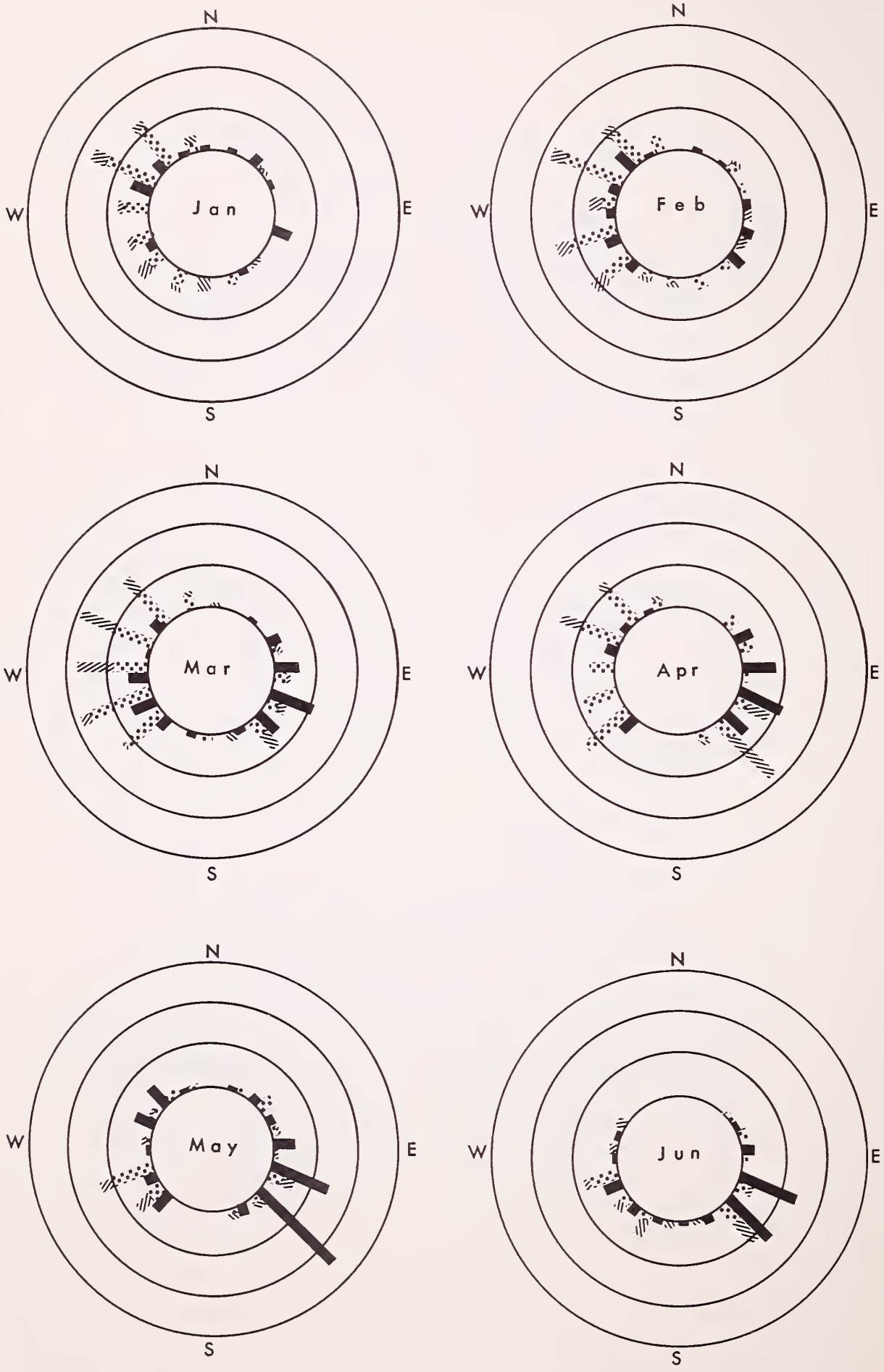
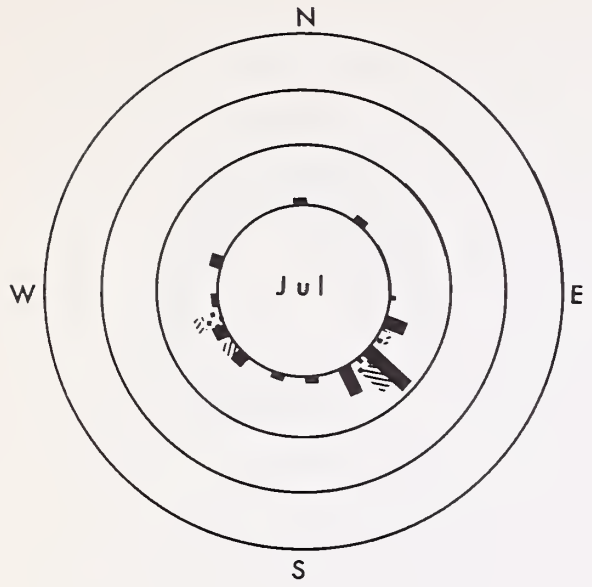
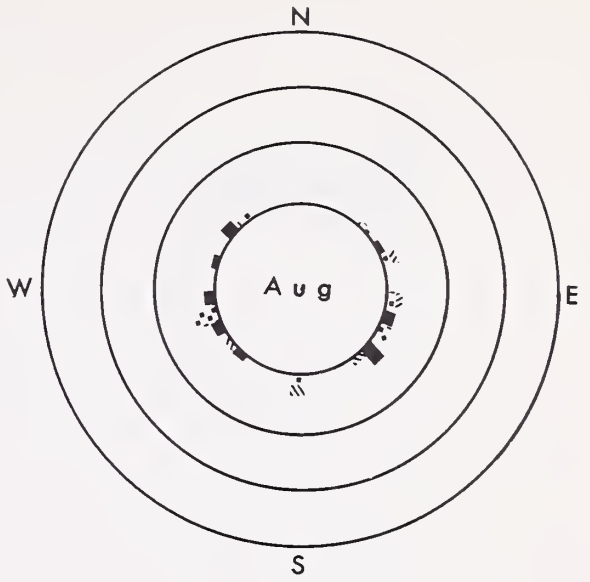
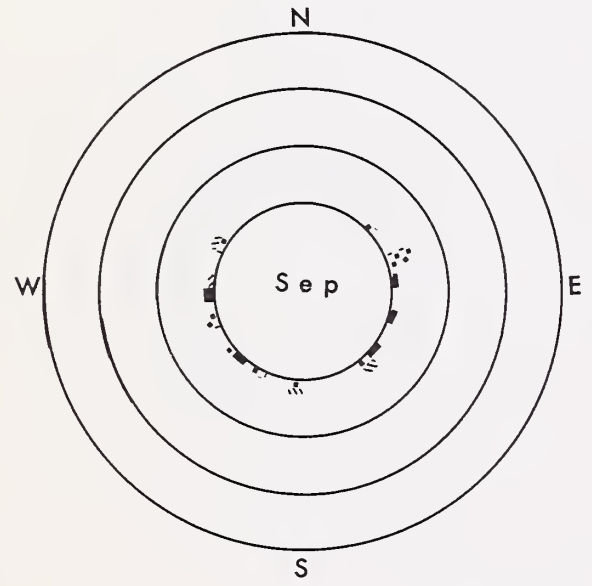
JACKSONVILLE, FLORIDA (nighttime)

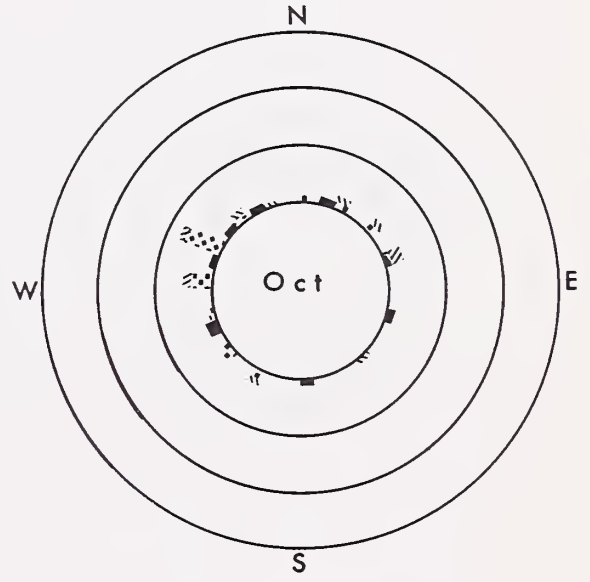


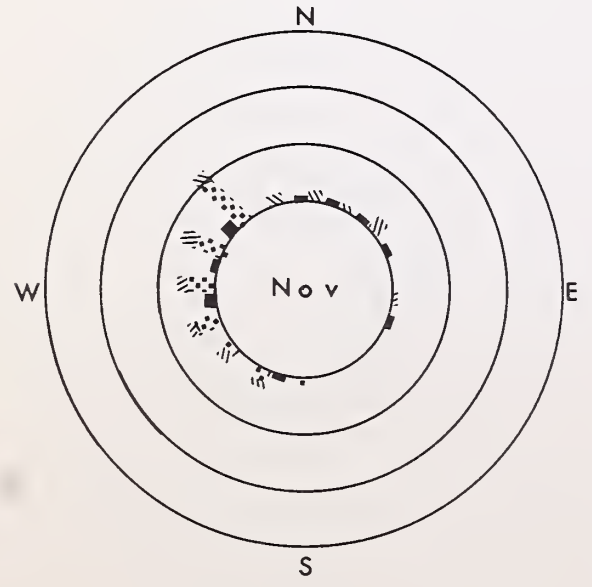
JACKSONVILLE, FLORIDA (nighttime)

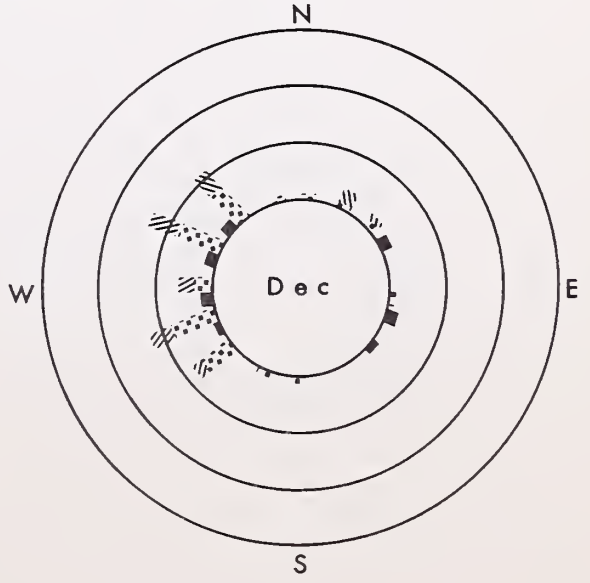




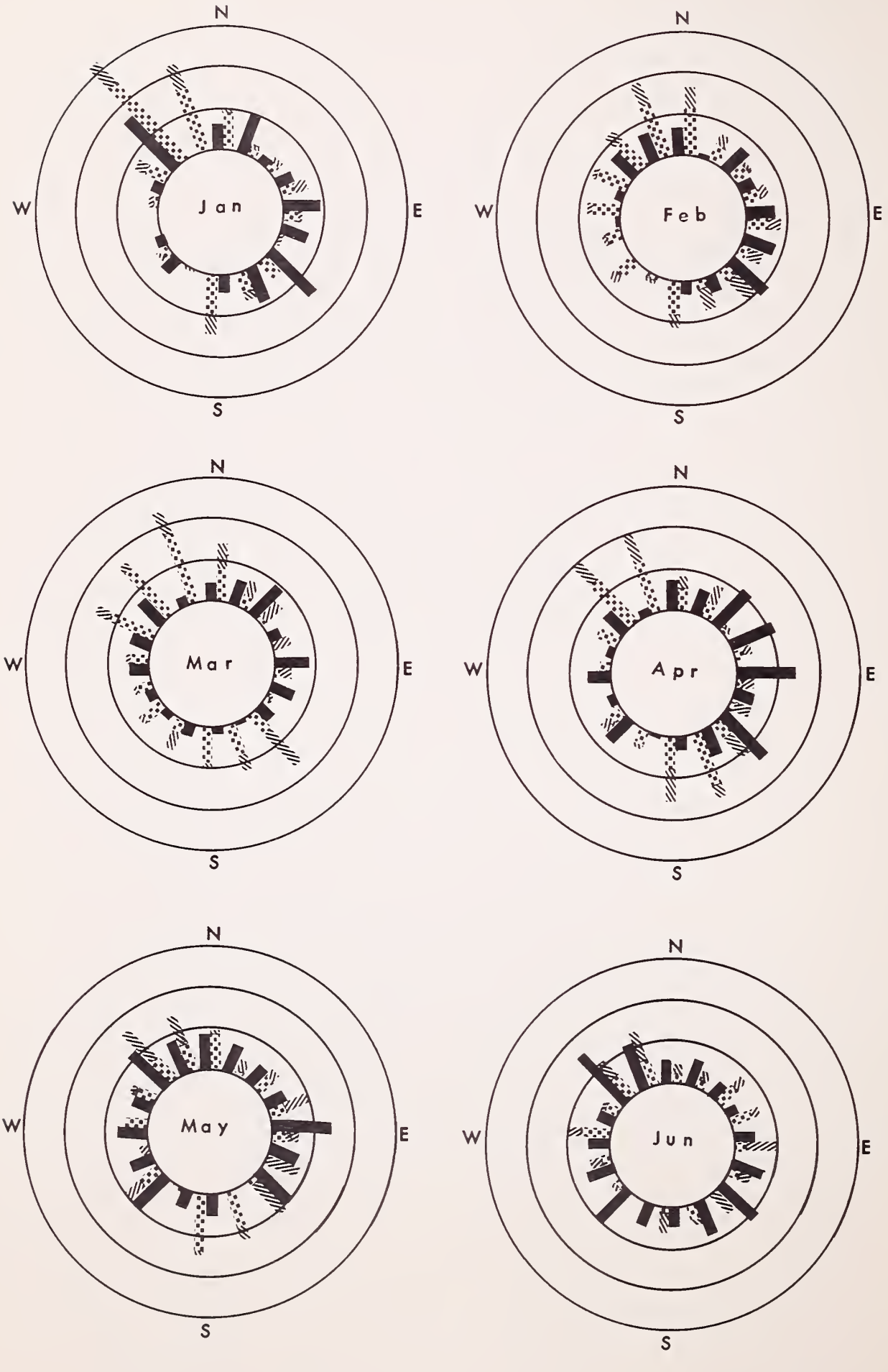




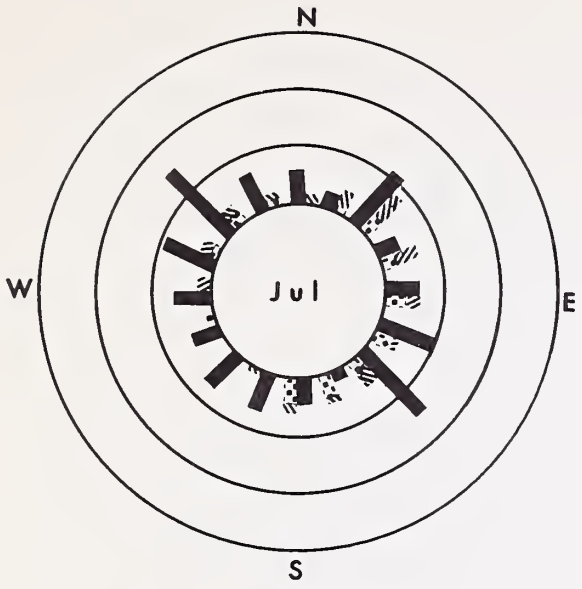


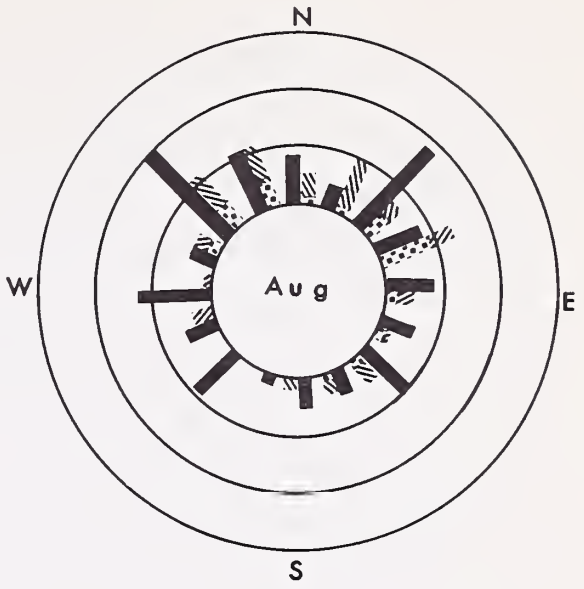


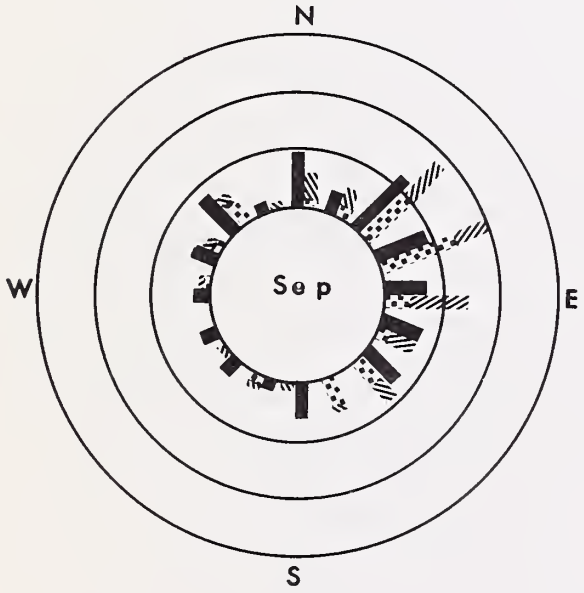
TALLAHASSEE, FLORIDA (daytime)

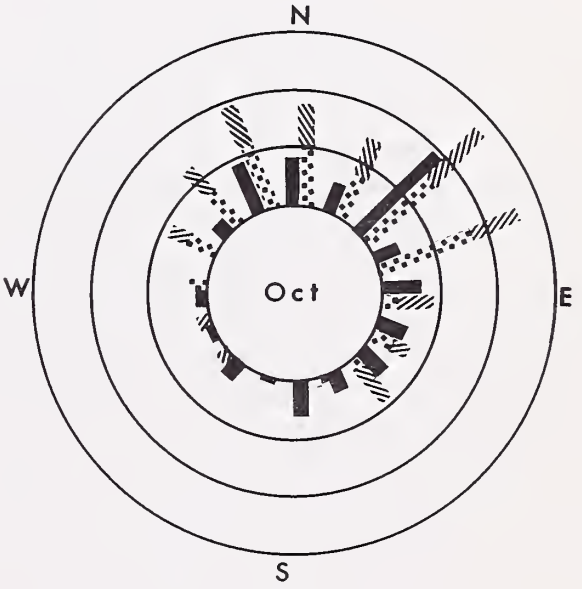


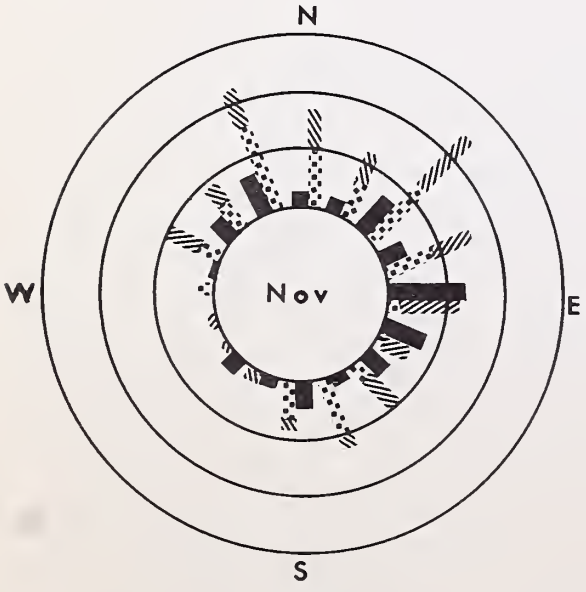
TALLAHASSEE, FLORIDA (daytime)

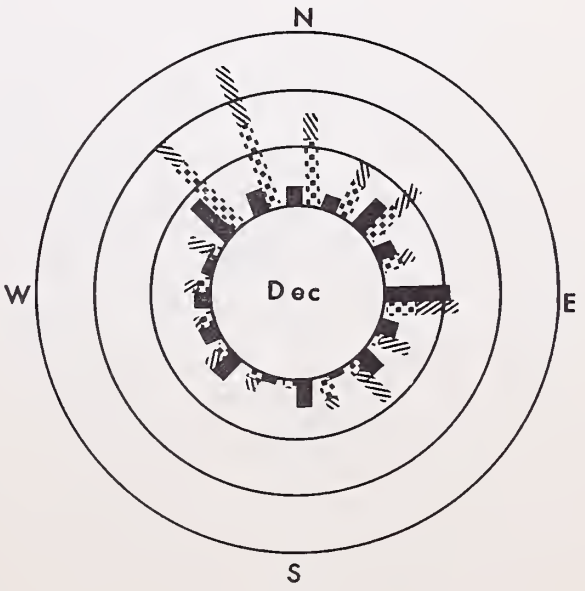




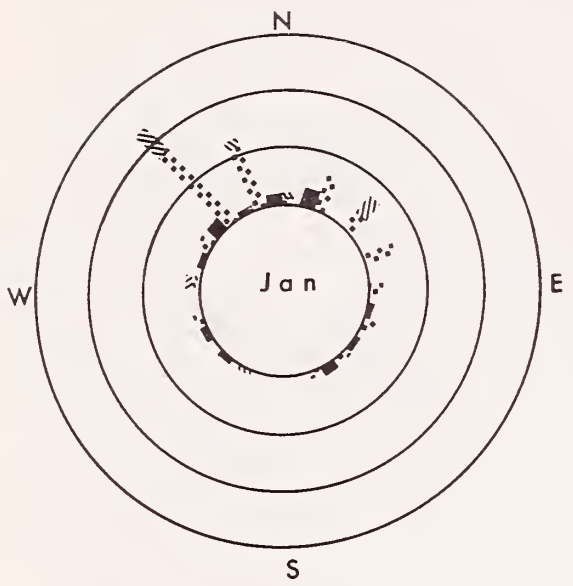


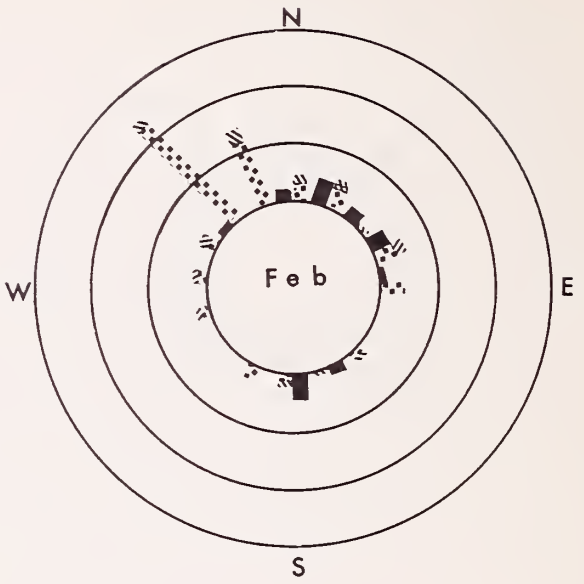


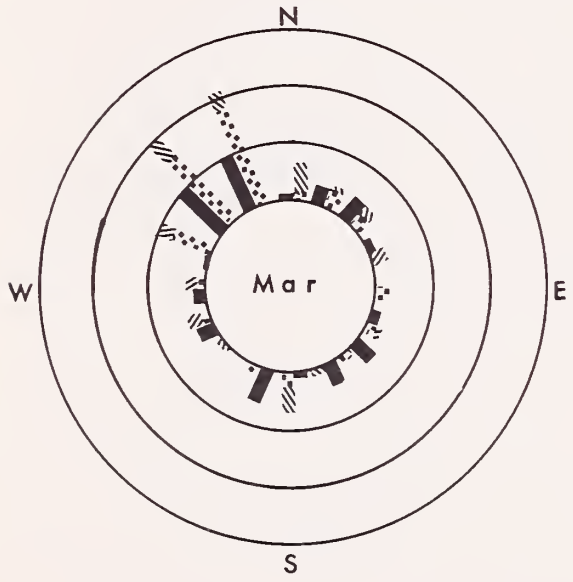


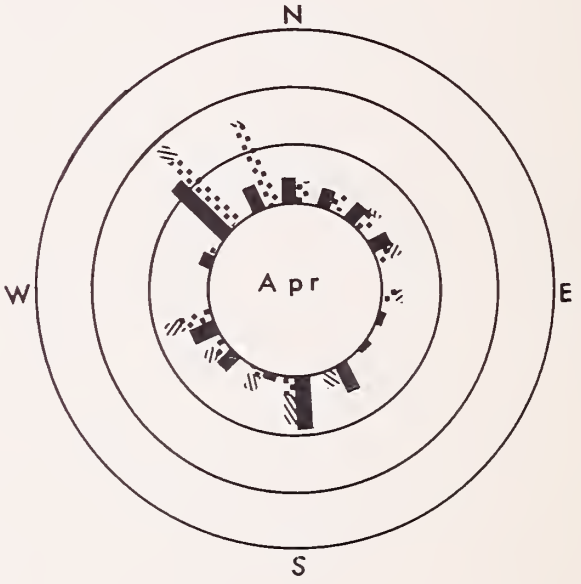


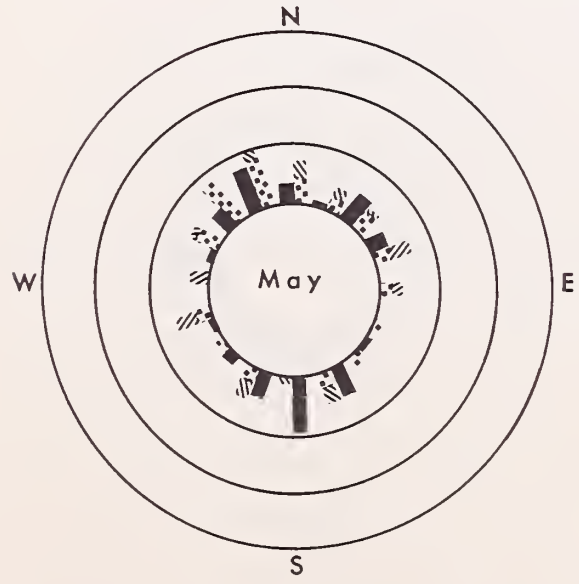
TALLAHASSEE, FLORIDA (nighttime)

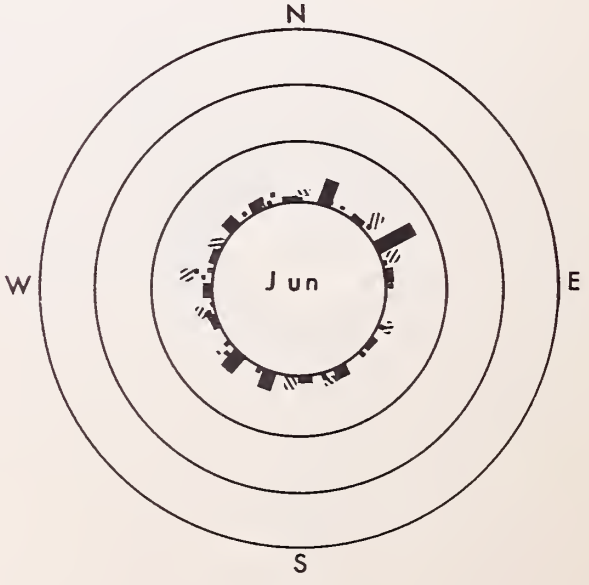




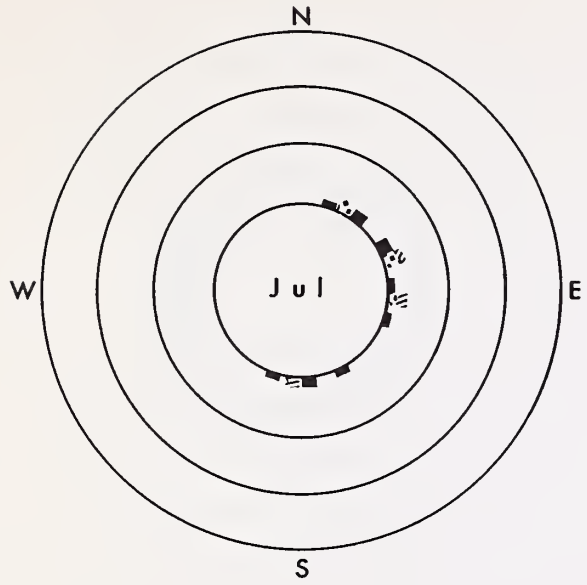


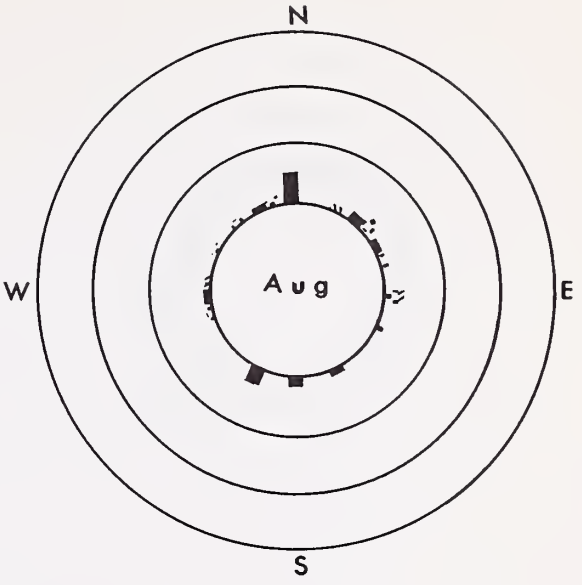


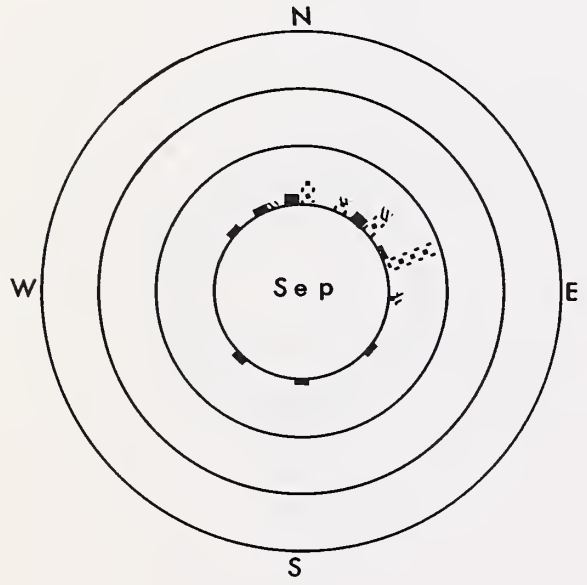


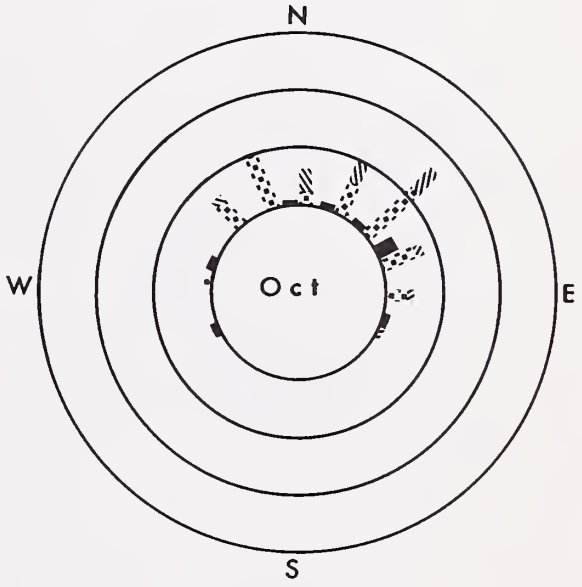


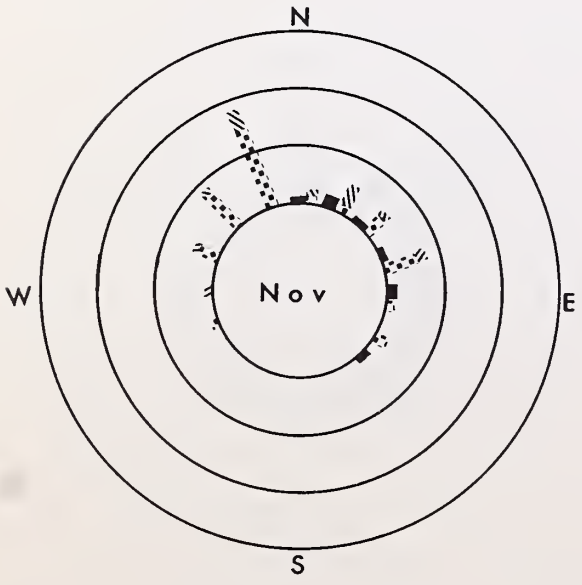
TALLAHASSEE, FLORIDA (nighttime)

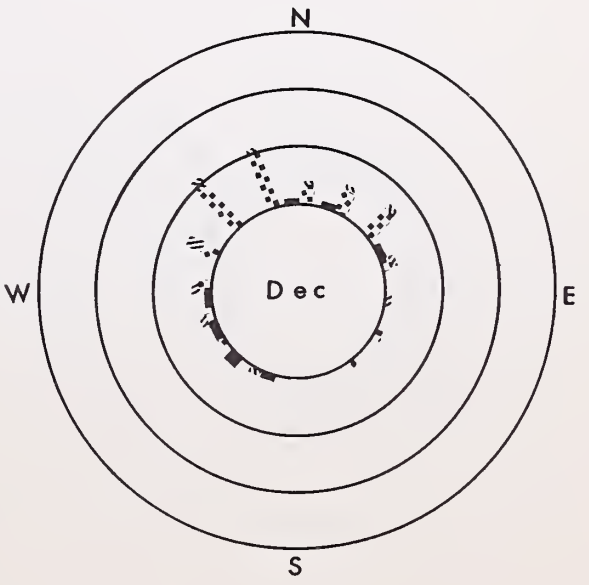




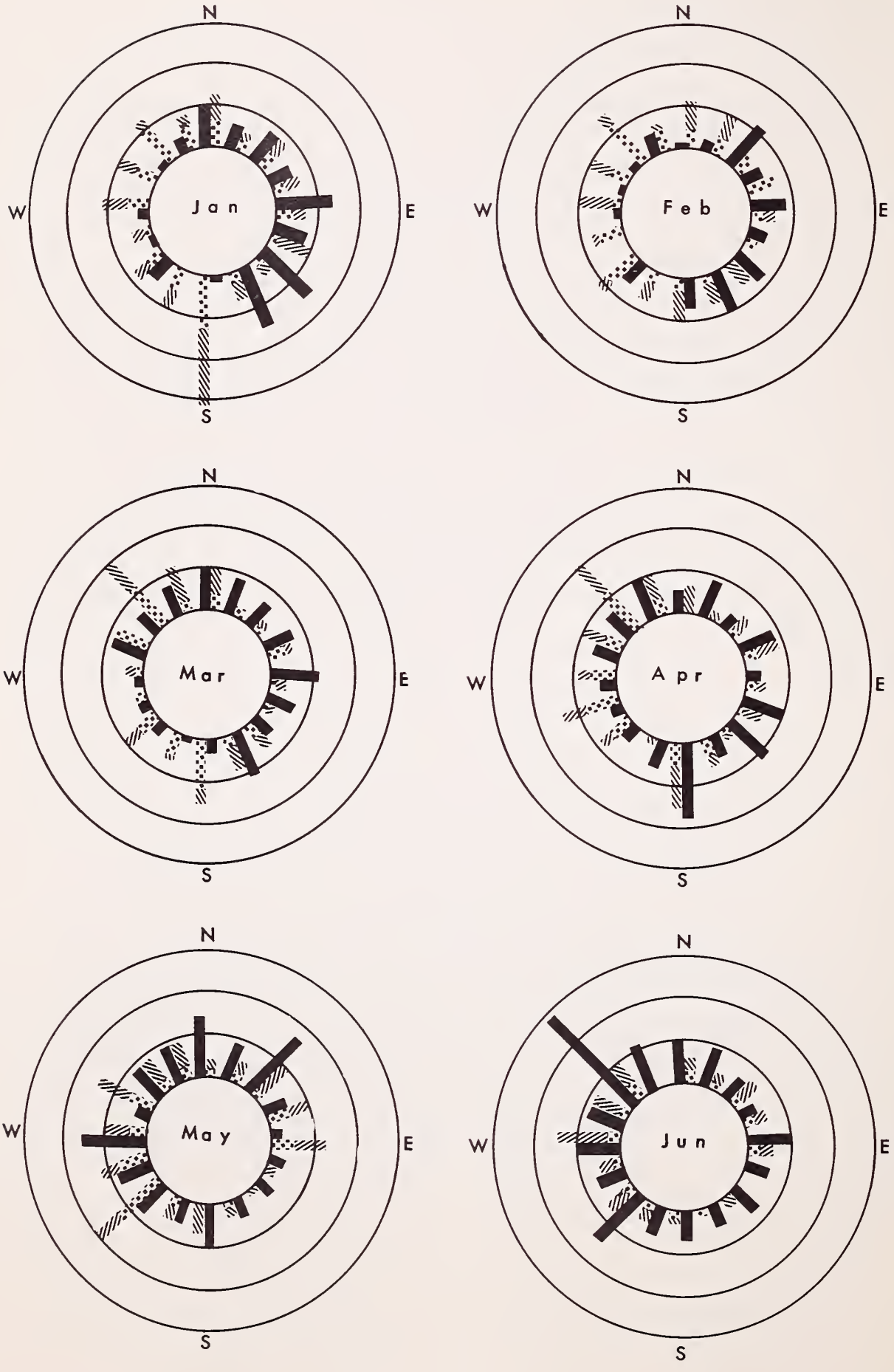




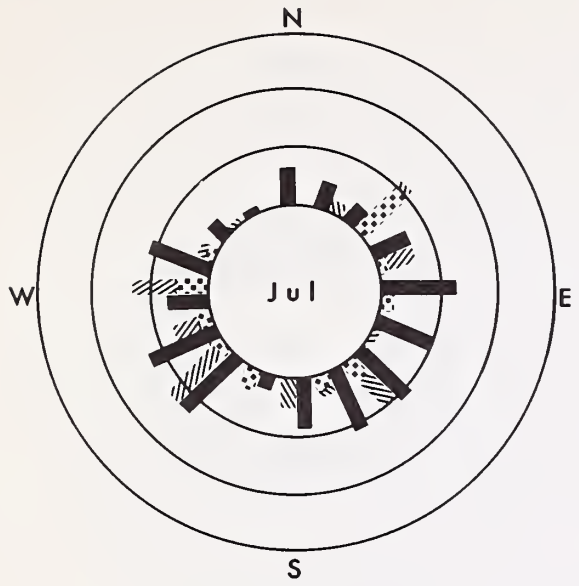


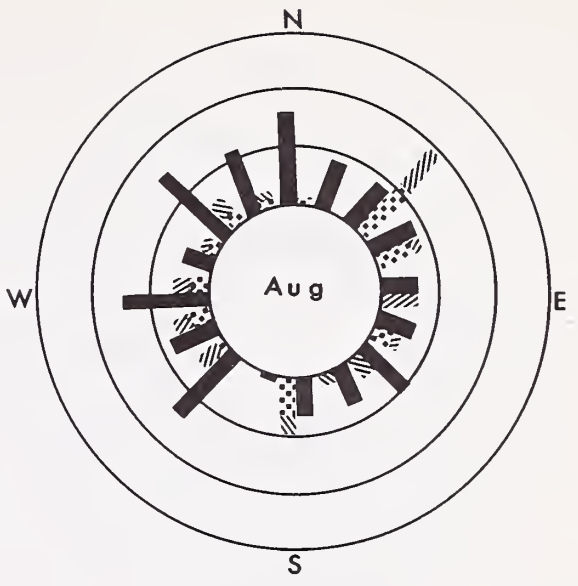


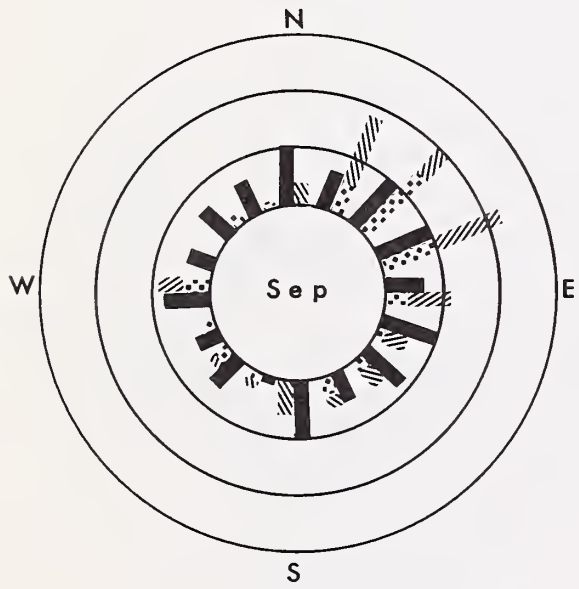
VALDOSTA, GEORGIA (daytime)

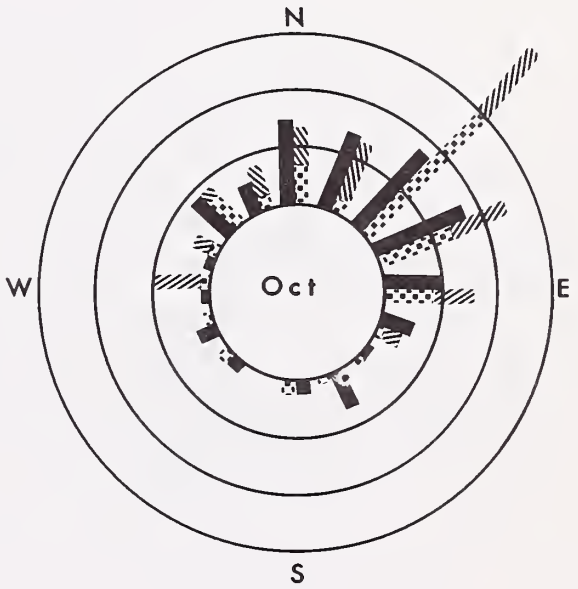


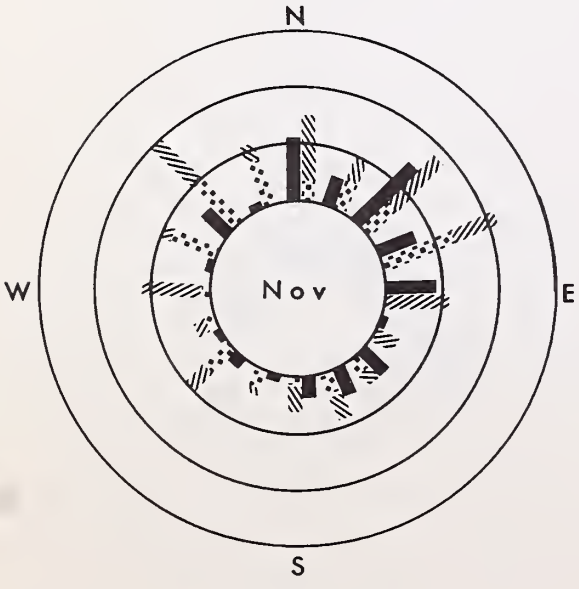
VALDOSTA, GEORGIA (daytime)

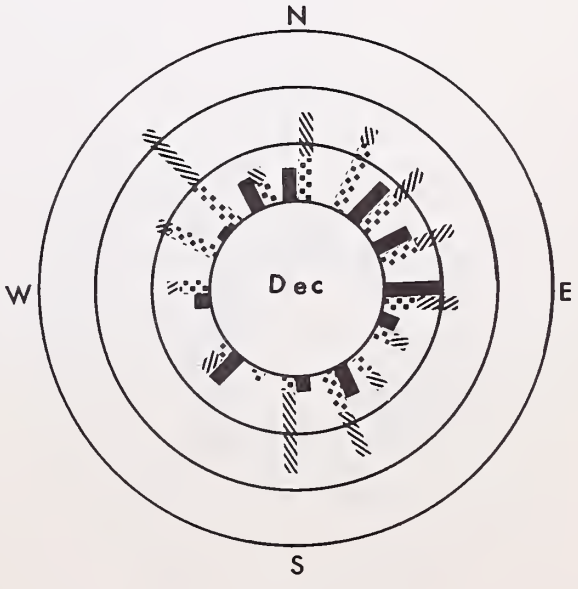












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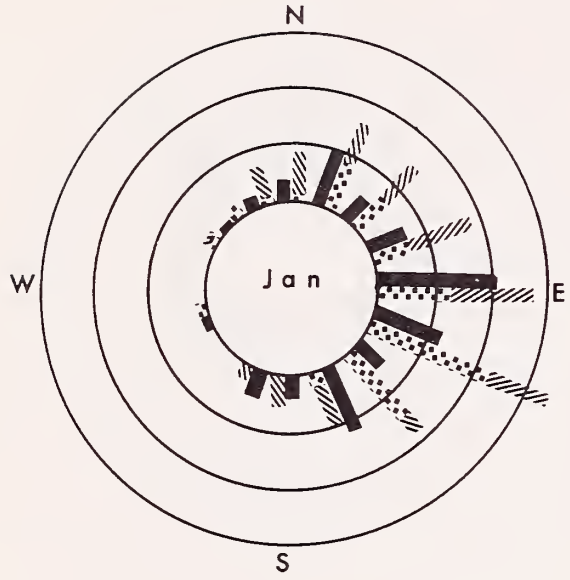

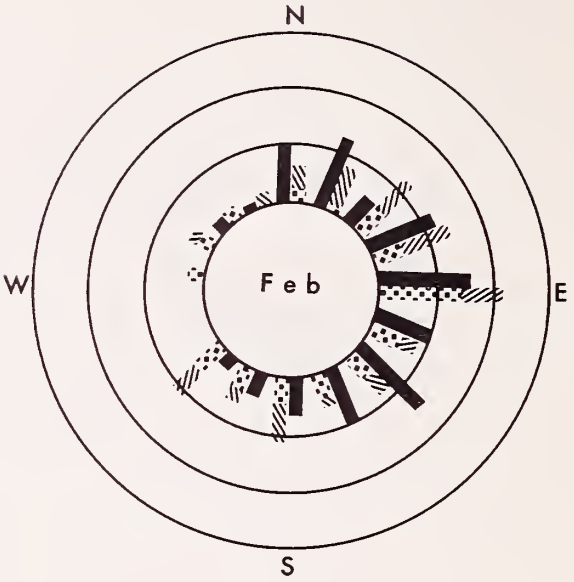

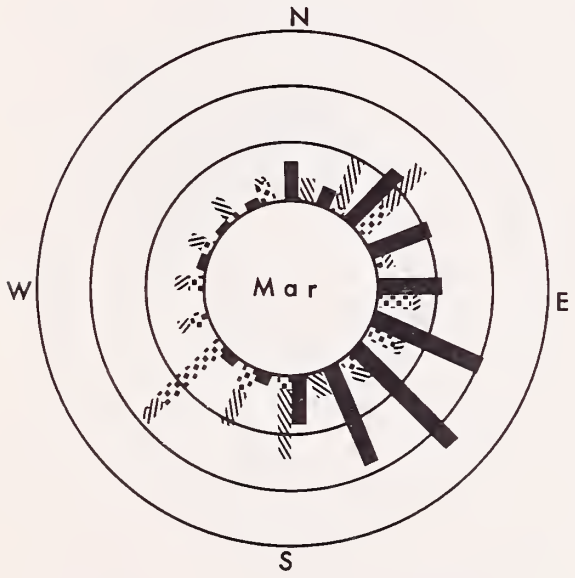

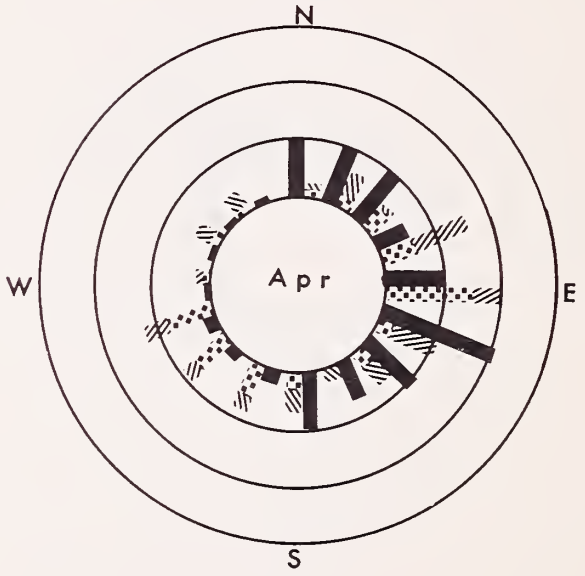

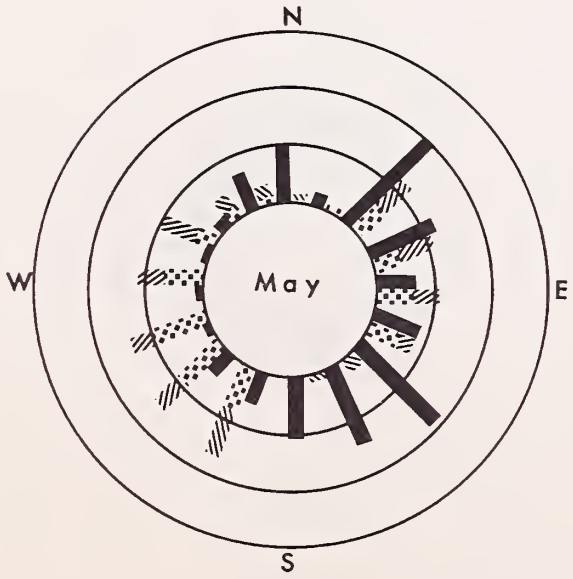

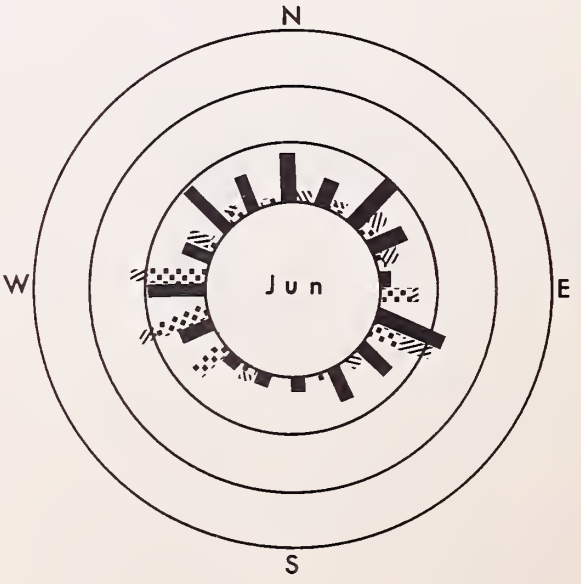

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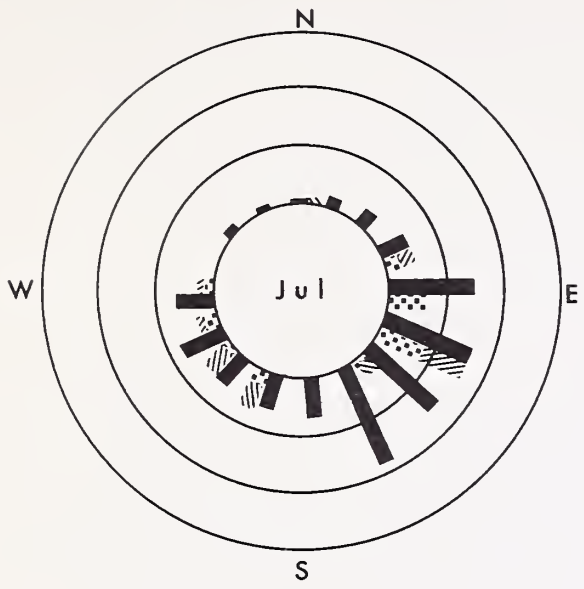

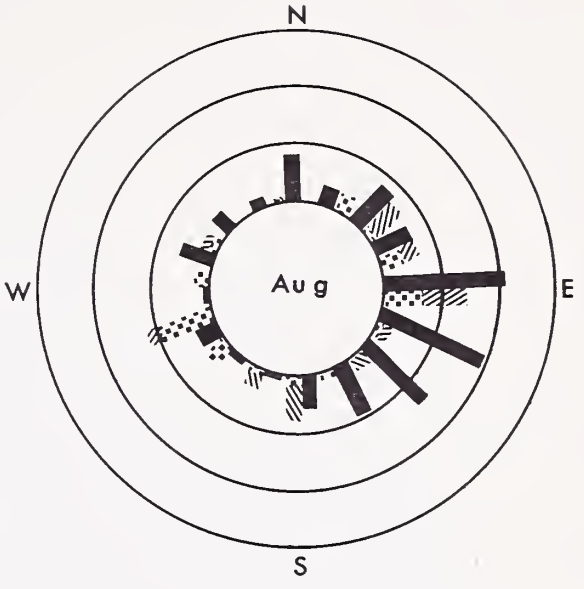

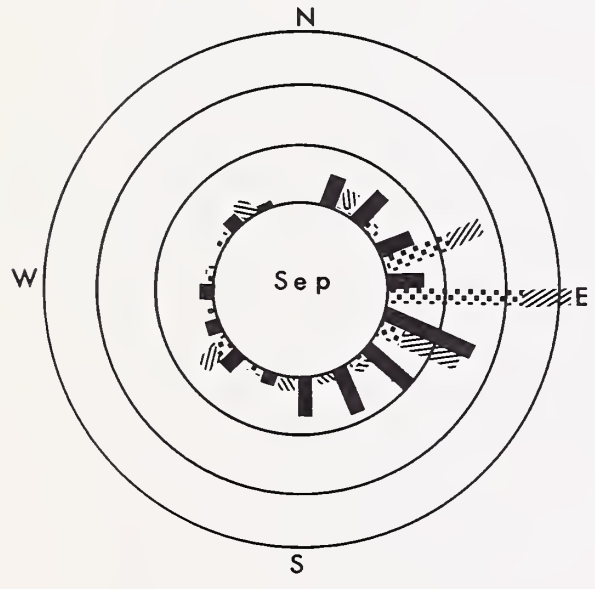

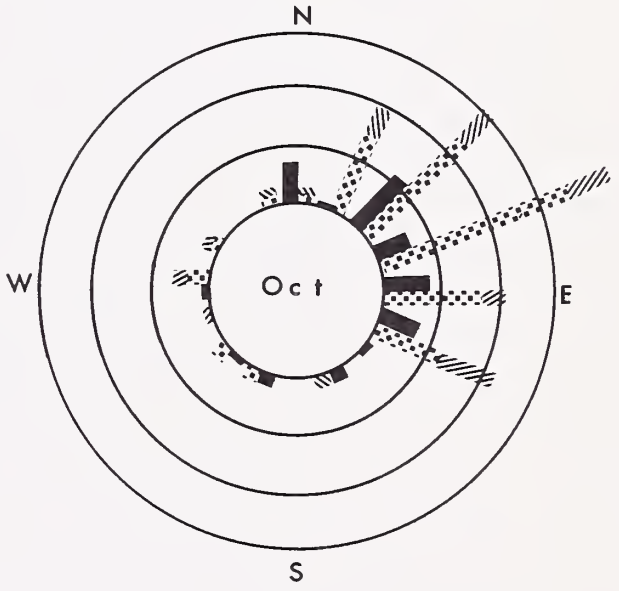

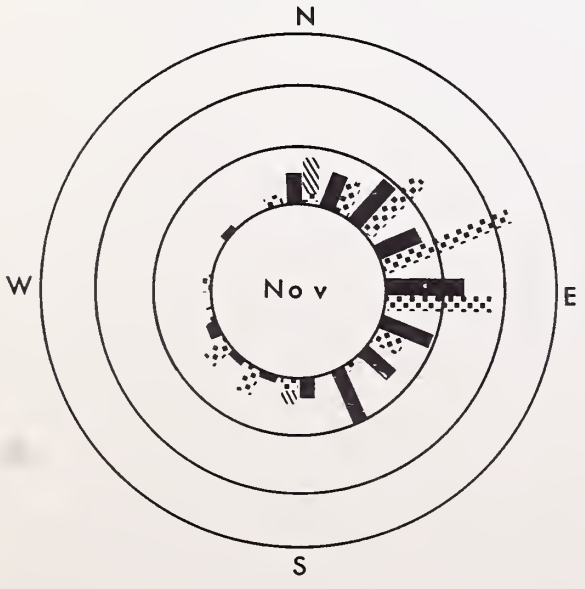

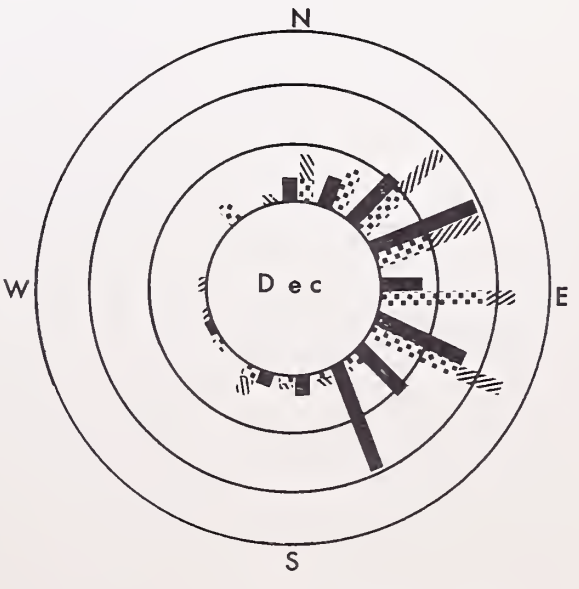

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